St. George & the Dragon

Design and production of a cultural heritage museum installation using media archaeology

Mercedes Said

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Aalto University
School of Arts, Design
and Architecture

Aalto University, P.O. BOX 11000, 00076 AALTO
www.aalto.fi

Master of Arts thesis abstract

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Media archaeology is a field of media research investigating new media cultures through material manifestations. Although often recognized as an approach to art, its use as an approach to design has not been fully explored. Media archaeology can be valuable because it offers alternative qualities of mediation, as a design palette, to that of prescriptive common media devices. This thesis describes a media archaeological approach towards the design of a cultural heritage media installation, exhibited at Häme Castle between April–December 2017, and produced as a collaboration between the National Museum of Finland (Kansallismuseo) and the Systems of Representation research group in the Department of Media at Aalto University in Finland. The installation displayed a multi-view stereoscopic (3D) digital reconstruction of a medieval sculptural scene of St. George and the Dragon, based on preserved, fragmented medieval sculptures from the museum's archives. Four stereoscopic video viewers were synchronized to a rotating central physical display, affording visitors an effect of augmented reality, without the need for a mainstream augmented reality implementation. Though the work was time-limited and project-driven, the design approach achieved a well-integrated installation that was sensitive to the aims of an exhibition of sculpture within a cultural heritage museum: artistry, materiality, interpretation. This thesis therefore seeks to argue that media archaeological approaches to design can identify historical ideas that can be remediated into relevancy for new contexts, and, in spite of their historical connotations, foster engaging technological experiences for the contemporary audience, that are sensitive to the aims of an exhibition of cultural heritage.

Keywords	media archaeology, stereoscopic, installation, cultural heritage, new media, augmented reality

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Chapter 1

Introduction

New media experiences are continually being integrated into the museum environment; doing so offers ways to provide new experiences of archival content, objects, information and education. The benefits of technological integration are seen as a necessary progression for the museum[1]—the museum, itself, is a cultural institution's interface with the public, thus, new innovations for exhibitions can be critical in attracting new audiences.

The integration of technology is not a recent topic in museum studies, however; for over a century, debate has sparked regarding the effect of these integrations on the integrity of the exhibitions and content,[2] and also in relation to the preservation of cultural heritage.[3] As new experiences begin to blend the boundaries between education, interaction and entertainment, researchers are questioning the role and impact of technology in the museum context.[4] Of course, behind many of these experiences are collaborations between museums and new media designers, and it is the designer's work at the heart of much scrutiny within this debate.

This thesis presents research and reflection arising from the design and production of one such new media experience. The work—a new media installation

[1]Larry Johnson et al., *The NMC horizon report: 2015 museum edition* (Austin, TX: ERIC, 2015), p. 8.

[2]Kenneth Starr, "MER at 20: some observations on museum education," *Journal of museum education* 15, no. 1 (1990): 18–19; Alison Griffiths, "Media technology and museum display: a century of accommodation and conflict," chap. 22 in *Rethinking media change: the aesthetics of transition*, ed. David Thorburn and Henry Jenkins (Cambridge, MA: The MIT Press, 2003), 375–389.

[3]Yehuda E. Kalay, "Introduction: preserving cultural heritage through digital media," in *New heritage: new media and cultural heritage*, ed. Yehuda E. Kalay, Thomas Kvan, and Janice Affleck (Abingdon, UK: Routledge, 2008), 1–10.

[4]Johnson et al., *The NMC horizon report: 2015 museum edition*.

for a cultural heritage exhibition at the National Museum of Finland (Kansallismuseo)—reconstructed and displayed medieval sculptures using digital technology (Figs. 1.1&1.2). The focus of the design research for this project was two-fold. Firstly, the enquiry is 'looking at the present': analysing the debate and concerns surrounding the integration of technology within the cultural heritage museum. This is a very wide scope of investigation; technologies that have been adopted into the cultural heritage museum range from basic digital displays to holograms. Therefore, the focus for this thesis is narrowed specifically to the use of augmented reality and virtual reality. These media are increasingly being explored for heritage displays of three-dimensional form[5]—the type of representation that was most relevant to this project.

However, many characteristics in augmented reality and virtual reality, prior to any exploration of relevant use, have been driven by cultural factors: commercial interests, or design for distributed mass communication, or historical desires, such as striving for illusions of non-mediation.[6] These factors are materially manifested by the medium; they can predetermine qualities of a media work, and lead to difficulty on recontextualization into collective, cultural spaces such as the museum.

The second part of the research, therefore, looks for alternatives to these media to address some of the present concerns. It does so by 'looking to the past': conducting a media archaeological excavation to search for design inspiration. Media archaeology is a field of media research investigating new media cultures through material manifestations: historical discourse, artefacts and archives. It is not only a theoretical field—media archaeology has been described by prominent scholars such as Huhtamo[7] and Parikka[8] as an emergent approach to media art; for example,

[5]Mat Collishaw, *Thresholds*, 2017, Virtual reality/mixed media art installation; Lily Díaz-Kommonen, "Interactive diorama: a virtual reality (VR) reconstruction of The Anatomy Lesson of Doctor Nicolaes Tulp by Rembrandt, 1632," in *2017 IEEE international symposium on mixed and augmented reality (ISMAR-Adjunct)* (IEEE, 2017), 258–261; Detroit Institute of Arts, *Lumin*, 2017, Mobile augmented-reality experience; Isabel Pedersen, Nathan Gale, and Pejman Mirza-Babaei, "TombSeer: illuminating the dead," in *Proceedings of the 7th augmented human international conference 2016* (ACM, 2016), 24.

[6]J.D. Bolter and R. Grusin, *Remediation: understanding new media* (Cambridge, MA: The MIT Press, 1999); Matthew Lombard and Theresa Ditton, "At the heart of it all: the concept of presence," *Journal of computer-mediated communication* 3, no. 3 (September 1997): 389–396.

[7]Erkki Huhtamo, "Time-travelling in the gallery: an archaeological approach in media art," in *Immersed in technology: art and virtual environments*, ed. Mary Anne Moser and Douglas McLeod (Cambridge, MA: The MIT Press, 1996), 232–268.

[8]Jussi Parikka, *What is media archaeology?* (Cambridge, UK: Polity Press, 2012), p. 138-141.

Figure 1.1: Exhibited installation

Figure 1.2: Four stages of the digital reconstruction that were displayed in stereo. Topias Airas.

the work may engage with historical themes, reuse obsolete devices, or use historical archives. However, this project uses it as an approach to design, with a focus on artistic quality, and a slight pedagogical aspect. Media archaeology offers a common ground between cultural heritage and new media. As a design method, it mirrors concerns of heritage within the design process itself, and offers a thoughtful, reflexive way to display themes of heritage through technology.

Designers work in teams: this work was highly interdisciplinary, and involved a number of experts contributing significantly in many aspects, the details of which will be made clear. Here, the role of the the designer was to research the approach that would fulfil the brief in a sensitive way (i.e. media archaeology), conceptualize an outcome, and then work together with the team to realize the project. Relevant historical ideas found in a media archaeological excavation were composed into a new experience, artistically integrating technology into the cultural heritage museum context. The consequent outcome is discussed, and demonstrates that the media archaeological approach, for collaborations between museums and new media designers, can expand research in new, unanticipated directions; and, in spite of the inspiration being grounded in the historical, foster new experiences that are well-integrated, and engaging for the contemporary audience.

Chapter 2

Context and Theoretical Background

Presented here is a short analysis of the integration of new media work (predominantly VR & AR) into the cultural heritage museum context. Subsequently there is an explanation of the background to the theory which underpins the design method used in this project—media archaeology. Finally, examples of existing approaches to media art that are considered as media archaeological, are presented.

2.1 Looking at the present: an analysis of collaborations between cultural heritage and new media

> New digital media are commonly seen as dematerializing. The word 'virtual' is often used to describe the representations produced in these media as a world separate from, and substituting for, concrete reality ... it is worth remembering that media representations are also tangible physical things ... (Henning[1])

Cultural heritage museums are displays of material culture—our understanding of, and connection to, historical humanity through material means.[2] When a visitor

[1] Michelle Henning, *Museums, media and cultural theory* (Maidenhead, UK: Open University Press, 2006), p. 71.

[2] George W. Stocking Jr., ed., *Objects and others: essays on museums and material culture*, vol. 3, History of anthropology (Madison, WI: University of Wisconsin Press, 1988).

is examining an antiquity in a museum through *natural vision*, there is a direct connection to the material makeup of the object. Through this visual connection alone, sensorial qualities such as form, weight, density, temperature, texture, finish[3]—in addition to other more abstract qualities such as associated history, value (rarity), craftsmanship, process, techniques, permanence, decay, aesthetic, narrative[4]—are, to some extent, portrayed through material means. Chisel marks on a carving, paint traces on a ceramic, thumbprints in clay pottery—material is one language of the object narrative.

It is natural, then, to want to expose the narrative further in some way—this is the very core of cultural heritage museum display[5]—to highlight the understandings that have been deduced from these material traces. To do so requires a curatorial process; context is another language of the object narrative. Firstly, objects do not exist alone, they are displayed in relation to other objects in accordance with the narrative to be exposed; object collections have some conceptual thread to connect them. Secondly, supportive information provides re-contextualization, because the passing of time, and the display in a museum, removes the object from its original context. Commonly, this is done through a caption shown in conjunction with the object. Therefore, object discourse is imparted through the presence of the object with other cues in the space, be it through other conceptually relevant objects, or relevant additional information, experience or narrative.[6]

Trends in adopting media within the cultural heritage museum have primarily dealt with extending the contextual information provided to visitors through varying methods.[7] Audio guides were early augmentations that complemented the curated visual experience,[8] but increasingly visual media are being adopted for a sim-

[3]Roland W. Fleming, "Visual perception of materials and their properties," *Vision research* 94 (2014): 62–75.

[4]Elaine Heumann Gurian, "What is the object of this exercise? A meandering exploration of the many meanings of objects in museums," *Daedalus* (Cambridge, MA) 128, no. 3 (1999): 163–183.

[5]Catherine Eberbach and Kevin Crowley, "From living to virtual: learning from museum objects," *Curator: the museum journal* 48, no. 3 (2005): 317–338.

[6]Eberbach and Crowley, "From living to virtual: learning from museum objects"; E. Margaret Evans, Melinda S. Mull, and Devereaux A. Poling, "The authentic object? A child's-eye view," in *Perspectives on object-centered learning in museums*, ed. Scott G. Paris (Mahwah, NJ: Lawrence Erlbaum Associates, 2002), 55–77.

[7]Griffiths, "Media technology and museum display: a century of accommodation and conflict."

[8]Benjamin B. Bederson, "Audio augmented reality: a prototype automated tour guide," in *Conference companion on human factors in computing systems*, CHI '95 (ACM, 1995), 210–211.

ilar purpose.[9] With the expanding possibilities of interactive 3D representation, a recent emergence is the use of augmented reality (AR) as a medium to provide new experiences of cultural heritage collections.[10]

Outside of the museum experience, academics have expressed general caution towards the uptake of new media in the preservation of cultural heritage.[11] Attention has been brought to the tensions of translation—new media profoundly impacts the represented content and the way society consumes and interprets it.[12] This concern has also manifested through debate regarding the uptake of media experiences in the museum display. Griffiths[13] traces this museological debate back for a century, however, it still resonates today. For example, AR mediated through a tablet translates all physical material to pixels on a flat two-dimensional screen, and imitates additional physical material and ambient properties digitally. This is a considerable abstraction from the original object. Sensorial qualities of the material are replaced during the experience by new ones from the mediating object—shiny, new, precise, smooth, flat, lightweight, portable.

Commonly cited advantages of technology to museums include the provision of mass information, or larger scopes for computational analysis of digital material;[14] however, rarely do these new visual experiences within the museum manifestly use these advantages. In AR, the experiences are distributed throughout the museum on personal devices, the content is context-specific, or even object-specific (e.g. Lumin[15]). The experience largely requires the translation of contextual information into visual experience and digital storytelling (surface replacement, additional forms added etc.), to portray how things may have looked, how they may have been created or found, and other such processes that are indubitably linked to artistic practice and knowledge of material properties. In translating these contextual in-

[9] Rafal Wojciechowski et al., "Building virtual and augmented reality museum exhibitions," in *Proceedings of the ninth international conference on 3D web technology* (ACM, 2004), 135–144.

[10] Laia Pujol et al., "Personalizing interactive digital storytelling in archaeological museums: the CHESS project," in *40th annual conference of computer applications and quantitative methods in archaeology* (Amsterdam University Press, March 2012), 77–90.

[11] Kalay, "Introduction: preserving cultural heritage through digital media."

[12] Ibid.

[13] Griffiths, "Media technology and museum display: a century of accommodation and conflict."

[14] Lev Manovich, "Museum without walls, art history without names: visualization methods for humanities and media studies," in *Oxford handbook of sound and image in digital media*, ed. Carol Vernallis, Amy Herzog, and Jon Richardson (Oxford, UK: Oxford University Press, December 2013).

[15] Detroit Institute of Arts, *Lumin*.

formations to visual means, the designer becomes a translator of the original, and should be echoing the work from a knowledgeable insight of the original:

> The translator's task consists in this: to find the intention toward the language into which the work is to be translated, on the basis of which an echo of the original can be awakened in it. (Benjamin[16])

These are not contemporary issues in new media—Williams[17] described succinctly similar concerns by comparing verbal and visual information in television newscasts. Williams was critically aware of the differences of information between these translations, and these are concerns the are mirrored in the translations required by AR technology in the museum setting.

A key factor in the collaboration between heritage and new media is the active consideration towards the interests and nuances of the collaborating field. The heritage field concerns itself with the past; design and technology with the future. As an example, however, in pushing the boundaries of new digital experiences, the tendency of media design towards user-centred functionality overlooks facets of artistic method and material knowledge[18] that, as discussed, is a considerable nuance in the heritage field.[19] New digital experiences should involve innovation in both technological terms, and in terms of the interpretation of heritage. With many new media experiences being outsourced to high-tech companies, the commercial interests have been palpable in the work, and larger productions have been accused within the museum sector of "Disneyfication" of the cultural institution.[20] Novel experience with content integrity is a must, even though a museum, of course, relies somewhat on a commercial activity.[21]

Through the the very nature of the human-computer interaction in AR, the experience is presupposed as one of function, and suppresses the exploration of the

[16]Walter Benjamin, "The task of the translator" [foreword to Tableaux Parisiens: Deutsche Übertragung mit einem Vorwort Über die Aufgabe des Übersetzers von Walter Benjamin], ed. and trans. Steven Rendall, *TTR: traduction, terminologie, rédaction* 10 (2 1997): 151–165.

[17]Raymond Williams, *Television: technology and cultural form* (Berlin, Germany: Schocken Books, 1975), p. 48.

[18]Heekyoung Jung and Erik Stolterman, "Digital form and materiality: propositions for a new approach to interaction design research," in *Proceedings of the 7th Nordic conference on human-computer interaction: making sense through design* (ACM, 2012), 645–654.

[19]Daniel Miller, ed., *Material cultures: why some things matter* (London, UK: UCL Press, 1998).

[20]Lisa C. Roberts, *From knowledge to narrative: educators and the changing museum* (Washington, DC: Smithsonian Institution Scholarly Press, 1997), p. 69.

[21]Starr, "MER at 20: some observations on museum education."

technology as an artistic medium as a result. Design explorations should be encouraged to explore alternatives to standard, prescriptive interfaces.[22] Integrating a digital experience, such as AR, using personal devices consequently distributes the experience in the space, and also individualizes it. The experience is understood as an enhancement to the physical curation, rather than an artefact in its own right (e.g. The CHESS Project;[23] Tombseer[24]). This creates a curatorial tension—if the visitor is consistently viewing the space through a digital window, presented with both digital and physical objects, then attention should be paid to how the digital experience is mixed with the curation. Evidently, a museum relies on new attractions to rework archives into new exhibitions, the question is whether technology is being integrated effectively in the heritage field, given the above concerns.

The integration of virtual reality (VR) is additionally emerging in cultural heritage museums.[25] Mediated through a personal device, VR relies on a head-mounted display, used as an installation, rather than a distributed experience, such as AR. As a result, it is not limited only to providing contextual "enhancement", but a separate curated experience, therefore removing the presupposition of function. However, the development of sophisticated virtual spaces is a continuation for the discussion from Malraux's conception of a "museum without walls"[26]—whether cultural institutions should continue to confine themselves to physical boundaries at all. Again, this tension is evident in the museum itself—the VR headset is a futuristic object that naturally juxtaposes itself to the sensibilities of a cultural heritage display and the VR experience itself is also "hidden" from the exhibition space. Unless physical elements are additionally built to expand the material scale, and draw attention to the available experience (e.g. Time Machine[27]), the headset alone has inconsequential meaning and presence in the space.

VR also suffers the broader problem through the design of the device for a sin-

[22] Jung and Stolterman, "Digital form and materiality: propositions for a new approach to interaction design research."

[23] Pujol et al., "Personalizing interactive digital storytelling in archaeological museums: the CHESS project."

[24] Pedersen, Gale, and Mirza-Babaei, "TombSeer: illuminating the dead."

[25] Athanasios Gaitatzes, Dimitrios Christopoulos, and Maria Roussou, "Reviving the past: cultural heritage meets virtual reality," in *Proceedings of the 2001 conference on virtual reality, archeology, and cultural heritage* (ACM, 2001), 103–110.

[26] André Malraux, *The voices of silence* [Les voix du silence], trans. Stuart Gilbert (London, UK: Secker & Warburg, 1954).

[27] Helsinki City Museum, *Time machine*, May 2016, Virtual reality museum exhibit.

gle user—this comprises much of the current discourse of integrating VR into the museum experience.[28] Of course, to overcome this, multiple headsets could be employed, but this isolates many users, as opposed to creating social interaction during such experiences. Museums are now looking to immersive VR mediated through projectors[29] and wearable devices, to enable presence and multi-user viewing, although many interactions are mostly single-user experiences.[30] These configurations are primarily for spatial experience, but still exhibit the same material tensions.

Lastly, the natural interaction of visitors in an exhibition is to survey the space prior to the approach toward a display; consciously, or not, there will be some thought process, internal dialogue, or event that guides a visitor's direction and proximity to objects in the space, with which they have both active and passive engagements.[31] New media devices, such as VR headsets, do not allow for these varying styles of engagement, thus, it can be difficult to naturalize within the exhibition environment—this is also a current focus within the discussions of new media in the museum.[32] Virtual reality is not as widespread as other domestic technologies, thus may cause hesitation in approaching the work that requires active engagement if visitors are conscious of their inexperience.[33]

The aim of this analysis is not to minimize the contribution of the existing works, rather to examine the intricacies of a collaboration between the cultural heritage field and new media. Broadly, some key notions have been identified that have the potential to benefit the outcomes of 3D digital media experiences pertaining to heritage:

- In opposition to the assumption of new media as immaterial, it should be un-

[28] John-Mark Collins, "Current discourse on digital storytelling in museums," Accessed October 31, 2017, 2017, https://www.storylabinteractive.com/blog/2017/5/23/current-discourse-on-digital-storytelling-in-museums.

[29] Museums + Heritage Advisor, "Soluis heritage: the dome and taking virtual reality into museums," Accessed October 31, 2017, 2015, http://advisor.museumsandheritage.com/features/soluis-heritage-the-dome-and-taking-virtual-reality-into-museums/.

[30] Marcello Carrozzino and Massimo Bergamasco, "Beyond virtual museums: experiencing immersive virtual reality in real museums," *Journal of cultural heritage* 11, no. 4 (2010): 452–458.

[31] Jon Hindmarsh et al., "Creating assemblies: aboard the ghost ship," in *Proceedings of the 2002 ACM conference on computer supported cooperative work* (ACM, 2002), 156–165.

[32] Collins, "Current discourse on digital storytelling in museums."

[33] Bolter and Grusin, *Remediation: understanding new media*, p. 161; Carrozzino and Bergamasco, "Beyond virtual museums: experiencing immersive virtual reality in real museums."

derstood that new media experiences are material,[34] their materiality affects visitor interpretation,[35] and that greater focus in this area may ease tension between digital experiences of material culture.

- The inherent characteristics of media devices have a tendency to dictate the characteristics of the work—for example, the problems of VR to accommodate varying levels of engagement, and multi-user experiences,[36] as well as the issues of AR towards presuppositions of functionality.[37] These characteristics affect the scale of the work, the presence within the space and other material objects in it, in addition to the interaction with the visitor, for example, their movement.

- Translations of contextual information into digital visual experience and storytelling should do so with care and understanding toward shifts in meaning, and consider the balance between information and entertainment,[38] avoiding misrepresentations. The aim is to create new engaging experiences with content integrity.[39]

In conclusion, this contextual analysis sets up the research aims of a new collaborative approach, that seeks to refine the role of media in a cultural heritage museum, giving greater emphasis on materiality, artistic practice and sensibility towards material culture in a museum setting.

2.2 Looking to the past: a short introduction to media archaeology and remediation

Media archaeology is an area of emergent historically-tuned media research that investigates cultures of new media from the insights of the past. Through historical media archives, discourse and media artefacts, media archaeology emphasizes the

[34] Henning, *Museums, media and cultural theory*.

[35] Kalay, "Introduction: preserving cultural heritage through digital media."

[36] Collins, "Current discourse on digital storytelling in museums."

[37] Jung and Stolterman, "Digital form and materiality: propositions for a new approach to interaction design research."

[38] Griffiths, "Media technology and museum display: a century of accommodation and conflict"; Maria Roussou, "Immersive interactive virtual reality in the museum," *Proceedings of trends in leisure entertainment* (London, UK), 2001,

[39] Starr, "MER at 20: some observations on museum education."

discursive, and the material, manifestations of media culture.[40] The precise sense and scope of media archaeology is difficult to define, as scholars working under this label do so under a heterogeneity of methods.[41] However, Huhtamo and Parikka[42] trace the roots of media archaeology within two distinct traditions. Firstly, from adoption of Michel Foucault's notion of "archaeology" from his work, *L'archéologie du savoir* (translated as the "archaeology of knowledge"[43]), as a discursive analysis of the existence of an artefact, and surrounding conditions,[44] rather than a focus on the artefact itself. Secondly, from the use of the terminology as a traditional material analysis, to construct histories of new media. For example authors Ceram[45] and Mannoni[46] refer to the "archaeology of cinema" to examine historical media that serve as a prehistory of the medium itself, yet have very different approaches to their individual archaeologies.

Friedrich Kittler, one of the oft-cited fathers of media archaeology,[47] brought some clarity through developing Foucault's ideas, shifting the focus back to a materialist drive—to expose cultural practices and discourse that lead to an analysis of how media were created, and the surrounding cultures that sustained them in those settings.[48] For example, Kittler points to the relationship of mathematics and painting, such as those of Renaissance masters Brunelleschi and Alberti, as pixellating the world and presenting it in windows, before these concepts were used and sustained in technology.[49] The shift in approach by Kittler, has been cited as influenced from the works of Marshall McLuhan.[50] McLuhan's fundamental media theories on the medium as the message, examinations of shifts in scale, society and culture, and his emphasis on temporal connections, convergence, and translations of media have

[40] Erkki Huhtamo and Jussi Parikka, eds., *Media archaeology: approaches, applications, and implications* (Berkeley, CA: University of California Press, 2011), p. 2.

[41] Simone Natale, "Understanding media archaeology," *Canadian journal of communication* 37, no. 3 (2012).

[42] Huhtamo and Parikka, *Media archaeology: approaches, applications, and implications*.

[43] Michel Foucault, *The archaeology of knowledge* [L'archéologie du savoir], trans. A. M. Sheridan Smith (New York, NY: Pantheon, 1972).

[44] Parikka, *What is media archaeology?*, p. 6.

[45] C.W. Ceram, *Archaeology of the cinema* (New York, NY: Harcourt, Brace & World, 1965).

[46] Laurent Mannoni, *The great art of light and shadow: archaeology of cinema* [Le grand art de la lumière et de l'ombre, archéologie du cinéma], ed. and trans. Richard Crangle (Devon, UK: University of Exeter Press, 2000).

[47] Natale, "Understanding media archaeology."

[48] Parikka, *What is media archaeology?*, p. 6.

[49] Friedrich Kittler, *Optical Media* (Cambridge, UK: Polity Press, 2010), p. 54–62.

[50] Huhtamo and Parikka, *Media archaeology: approaches, applications, and implications*, p. 5.

had profound impact in media archaeology. Presently, then, the theoretical crossover by which media archaeological scholars connect their ideas are threefold.[51] Firstly, media archaeologists reject linear constructions of history, particularly those which exclude media that have no apparent place within the history—a criticism Huhtamo and Parikka[52] make of Ceram's[53] *Archaeology of the Cinema*. Subsequently, media archaeologists are focused to the recovery of meaning for those historical media that cannot be accounted for by linear constructions. Scholars such as Kluitenberg[54] and Zielinski[55] both emphasize the relevance of imaginary media (those that are "dead", failed, were never conceived, or remain as fantasy) to media history. Lastly, there is the methodological anarchy of media archaeology itself; the field lacks explicit definition precisely to encourage fresh, inspired approaches and explorations of media history[56] to understand the cultural situation of our contemporary digital world.

In addition, theorists Bolter and Grusin[57] and their book *Remediation*, have significantly impacted media archaeology. This concept is also influenced by McLuhan—specifically, his notable theory that "the 'content' of any medium is always another medium" McLuhan.[58] Remediation is defined as the representation of one medium in another, and is a distinctive characteristic within new media practice. Their work examines how old media are re-worked into the new. The theory of remediation introduces two different, and somewhat opposing logics exhibited in new media culture. The first is the logic of "transparent immediacy", where the medium is designed to be transparent during the experience. The virtual reality headset remains the clearest example of transparent immediacy, however another example is the desire towards an "interfaceless interface",[59] such as gesture-based interfaces.

[51] Natale, "Understanding media archaeology."

[52] Huhtamo and Parikka, *Media archaeology: approaches, applications, and implications*.

[53] Ceram, *Archaeology of the cinema*.

[54] Eric Kluitenberg, ed., *The book of imaginary media: excavating the dream of the ultimate communication medium* (Rotterdam, The Netherlands: De Balie / NAi Publishers, 2006).

[55] Siegfried Zielinski, *Deep time of the media: toward an archaeology of hearing and seeing by technical means*, trans. Gloria Custance (Cambridge, MA: The MIT Press, 2006); Siegfried Zielinski, "Modelling media for Ignatius Loyola. A case study on Athanasius Kircher's world of apparatus between the imaginary and the real," in *The book of imaginary media: excavating the dream of the ultimate communication medium*, ed. Eric Kluitenberg (Rotterdam, The Netherlands: De Balie / NAi Publishers, 2006), 28–55.

[56] Natale, "Understanding media archaeology."

[57] Bolter and Grusin, *Remediation: understanding new media*.

[58] Marshall McLuhan, *Understanding media: the extensions of man* (1964; Reprint, Cambridge, MA: The MIT Press, 1994), p. 1.

[59] Bolter and Grusin, *Remediation: understanding new media*, p. 23.

Immediacy is employed to bring the user closer to the mediated experience, as a natural interaction. According to Bolter and Grusin,[60] it is a continuation of a historical desire, that is even demonstrated in early techniques, such as linear perspective in painting that dissolved the two-dimensional surface of the canvas. The second logic is "hypermediacy". It emphasizes that mediation is occurring by having many media represented in one mediated space—each demands the user's attention, for example a collection of windows or icons on a desktop. In contrast to immediacy, hypermediacy is a continual reminder to the user of the multiplicity of representations within the experience—combinations of sounds, texts, images, menus, buttons, links, folders, all which refer to old concepts that are remediated in the new. These two logics comprise remediation. Thus, whilst Bolter and Grusin do not define themselves as media archaeologists, these logics and concepts of understanding new media, in relation of the re-working of old media, are important to the field.

2.3 Media archaeological approaches to media art

As a result of the openness in the field, scholars such as Huhtamo[61] have also discussed the emergence of media archaeology as an approach to artistic practice. There is a common archaeological thread in many artworks since the 1990s; artists such as Paul DeMarinis, Bernie Lubell, Jeffrey Shaw, Michael Naimark have been identified, among others, as early artist-archaeologists.[62] Parikka[63] identifies a younger generation of artists with similar archaeological approaches—Sarah Angliss, Rosa Menkman, Garnet Hertz, Gebhard Sengmüller and others.

An early artwork selected by Huhtamo[64] as using a media archaeological approach was Naimark's *SEE BANFF!*[65] (Fig. 2.1), for the use of contemporary content (video of views filmed around Banff and rural Alberta, in Canada) and an outer form similar to Edison's Kinetoscope, where the user hand-cranks the frames to view the stereoscopic stop-frame video. This work re-used the Kinetoscope relatively liter-

[60] Bolter and Grusin, *Remediation: understanding new media*, p. 30-31.
[61] Huhtamo, "Time-travelling in the gallery: an archaeological approach in media art."
[62] Ibid.
[63] Parikka, *What is media archaeology?*, p. 137.
[64] Huhtamo, "Time-travelling in the gallery: an archaeological approach in media art."
[65] Michael Naimark, *SEE BANFF!*, 1994, Interactive stereoscopic installation, from "Field Recording Studies" (#3) art and virtual environments project, The Banff Centre for the Arts.

Figure 2.1: *SEE BANFF!*, Michael Naimark, 1994.
Michael Naimark, "3D moviemap and a 3D panorama," in *Proceedings SPIE*, vol. 3012 Stereoscopic displays and virtual reality systems IV (SPIE, 1997), p. 300

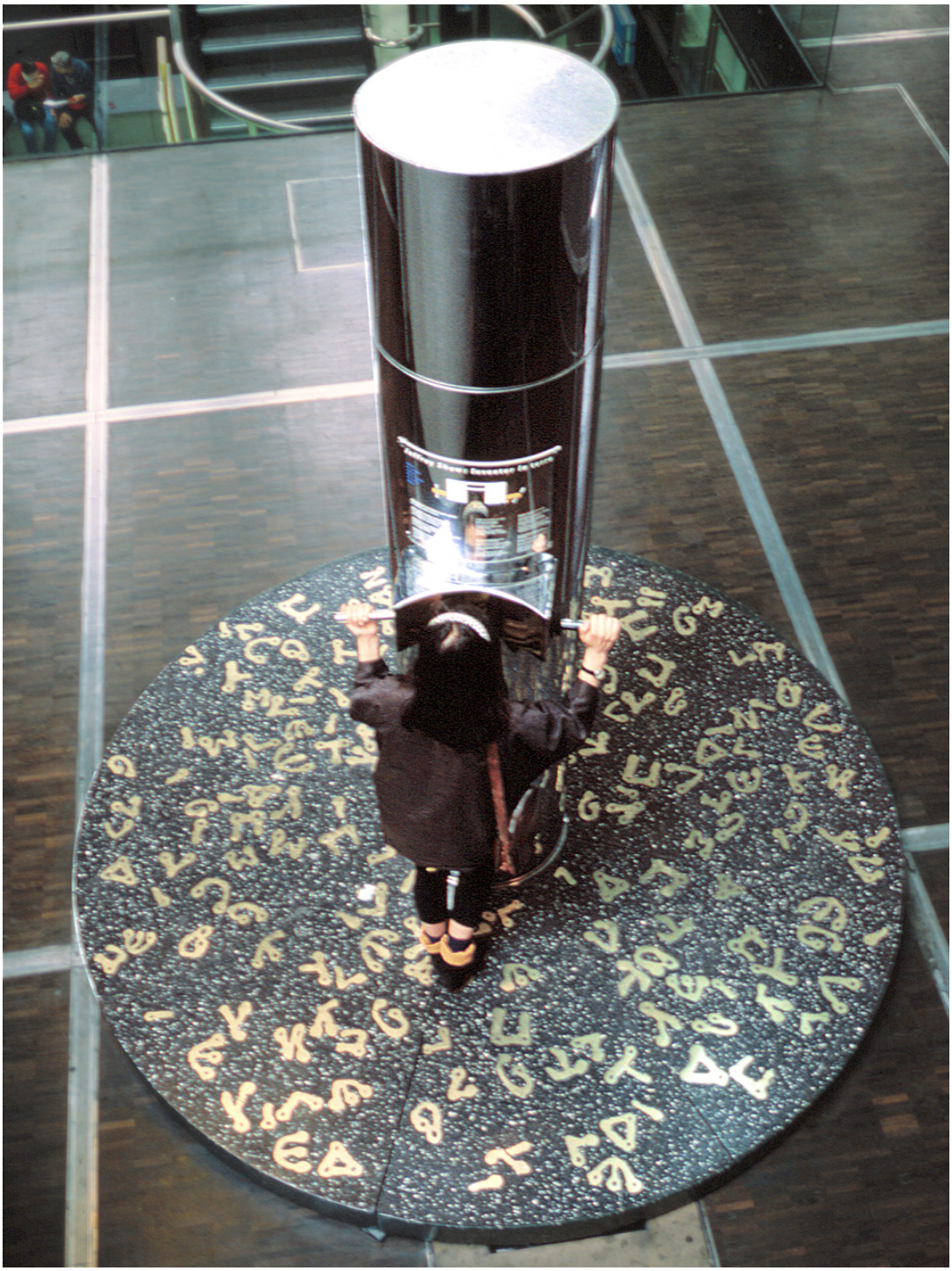


Figure 2.2: *Inventer la terre*, Jeffrey Shaw, 1986.
Huhtamo, "Time-travelling in the gallery: an archaeological approach in media art," p. 247

ally; it is faithful to its function and nineteenth century exterior aesthetic. However, works can be more interpretive of historical media, alluding to the form, rather than re-using it directly. An example of this is Shaw's *Inventer la terre*[66] (Fig. 2.2), that is almost periscope-like in function—the outer form turns to allow a panorama of the surrounding space to be observed. The outer form, however, could also be interpreted as "an ancient cosmological monument"[67] in aesthetic. Internally, controlled by external buttons, a user could superimpose computer-generated mirages over the views to animate the space—the work is a skilful combination of external form, internal contemporary visual experience, and varying interpretations of time.

A media archaeological approach to art scrutinizes technologies of the past as cultural forms—bearers of cultural and social meanings—rather than simply technological gadgets. Parikka[68] outlined six different ways old media technology and their themes could be resurrected in a contemporary art context; he intends this as a heuristic tool rather than an exhaustive list:

- Artworks that visually engage with historical themes; for example, nostalgic 8-bit graphics used in animation and video games on contemporary devices that are not constrained by technical limitation to this aesthetic.

- Art that constructs alternative histories, and offer new critical insights into contemporary digital culture, usually through subverting material choices or narratives that would usually be associated to the medium; for example, *Archaeology of Intention* by Lubell,[69] is an interpretation of a stone-age computer, where selecting digital buttons, and touching screens is replaced by heaving on colour-coded ropes to mechanically move the display. Also, the first iteration of *The Messenger* by DeMarinis,[70] that is inspired from early proposals of the electrical telegraph, converting digital message driven by the internet, in to pulsating wooden installation of the alphabet.

- Artwork stemming from obsolescence, exploring their potentials further, or

[66] Jeffrey Shaw, *Inventer la terre*, March 1986, Interactive augmented reality installation, Cité des Sciences et de l'Industrie, Paris, France.

[67] Huhtamo, "Time-travelling in the gallery: an archaeological approach in media art," p. 246.

[68] Parikka, *What is media archaeology?*, p. 138–141.

[69] Bernie Lubell, *Archaeology of intention*, 1992, Mechanical art installation, San Francisco Arts Commission Gallery.

[70] Paul DeMarinis, *The messenger*, 1998, Media art installation.

otherwise reusing, or possibly reconstructing them, into new forms for artistic purposes; for example *Aerial Prototype* by Hunger[71] that rebuilds a radio transmitted 'numbers station', a media relic of the Cold War; or, *Chac-Mool* by Bustamante,[72] a multi-sensory artwork including an old stereoscope viewer to display a contemporary video. Also, many works from *The Art of the Overhead* festival, founded by Gansing & Hilfling,[73] that invited artists to creatively explore the unlocked potential of the overhead projector, are related to this category.

- Works that construct imaginary media; for example, resurrecting dead media, forgotten media, or those that were never realized and remained fantasy; an example in media art is *Big Paul* by Sengmüller,[74] that offers an alternative development in the history of the television. Sengmüller resurrected the Nipkow disk—an historical T.V. scanning device that was eventually superceded by alternatives offering better resolution—but in a greatly enlarged scale, to achieve a good resolution. In doing so, an audience can better comprehend the 'digitality' that is visibly produced through the mechanics, more than an equivalent closed-box medium.

- Art that draws upon, and is informed by, historical archives, such as utilising historic film or audio footage; an example are the "Dream Films" from the *DREAMLAND* exhibition by Zoe Beloff,[75] created to celebrate an obscure society of amateur psychoanalysis enthusiasts from 1930's on Coney Island, in parts using film footage that society members recorded at the time.

- Works that not only look to the past, but look inside the machine as a manifestation of it; examples include art/activist practices such as circuit bending or hardware hacking, for example, the experimental instruments of Reed Ghazala,[76] by altering the electronics of obsolete toys into unique alien instruments.

[71] Francis Hunger, *Aerial prototype*, 2014, Media art installation of a shortwave radio station.

[72] Nao Bustamante, *Chac-Mool*, 2015, Mixed media installation with stereoscopic video.

[73] Kristoffer Gansing, *Transversal media practices: media archaeology, art and technological development* (Malmö, Sweden: Malmö University, 2013), p. 195–264.

[74] Gebhard Sengmüller, *Big Paul*, 2016, Media-archaeological installation of a large Nipkow disk.

[75] Zoe Beloff, *DREAMLAND: the Coney Island amateur psychoanalytic society and their circle 1926–1972*, 2009, Art exhibition, Coney Island Museum, NY.

[76] Reed Ghazala, *Circuit-bending: build your own alien instruments* (Indianapolis, IN: Wiley Publishing, 2005).

When applying the principles of media archaeology to media art, it can be helpful to split the design approach into two parts: a phase of excavation—the media archaeological research, historical and theoretical contextualizations—and a phase of intervention—reflecting on the excavation to interpret new connections between temporality, materiality, and cultures.[77] These research findings and ideas can then be remediated into new formats.

By using understandings of historical media devices, and identifying their possibilities for new interpretation and/or remediation, media archaeology can provide new approaches to media art; however, there is also a growing indication that the media archaeological approach can be used successfully to create installations that have some requirement for pedagogy. The nature of the archaeology undertaken, in combination with the design intent of the piece, will determine the characteristics of an installation—in this case, for example, the level of interplay between design, artistry and education. Huhtamo[78] had alluded to media archaeological approaches to art as just that—art—because they do not resort to didacticism. However, collaborations between artists and cultural institutions have demonstrated skilful balances between art, design, entertainment and education, using media archaeology as a their approach.[79] A discussion of what is, and what is not, art is well beyond the scope of this thesis; however, the hesitation to describing these installations as art due to their pedagogic reason for commission overlooks the fact that art, at least historically, was both commissioned and may also be created to inform, instruct and inspire, in addition to having artistic merit. Media archaeology is thus a very useful approach to integrating media installations into the museum setting.

Summary

For the same reason that heritage museums are often housed in unique historic buildings—as they evoke a sense of history and cultural value—when mediating narratives pertaining to cultural heritage it is valuable to be sensitive towards the material culture of the medium. The media archaeological approach offers a crossover

[77] Gansing, *Transversal media practices: media archaeology, art and technological development*.

[78] Huhtamo, "Time-travelling in the gallery: an archaeological approach in media art," p. 256.

[79] Díaz-Kommonen, "Interactive diorama: a virtual reality (VR) reconstruction of The Anatomy Lesson of Doctor Nicolaes Tulp by Rembrandt, 1632"; Matti Niinimäki, "Interface bending as a media archaeological approach for interactive art" (master's thesis, Aalto University, 2016).

between the fields of new media and cultural heritage to achieve this sensitivity. Media archaeology provides the opportunity to instil varied nuanced qualities in a work of media that are not offered by off-the-shelf devices, and thus many media artists have adopted this approach, even if they do not always explicitly describe their work as such.

In the next chapter, the project brief is introduced and then the approach of media archaeology pertaining to this work is discussed. Also described is the project-driven method and other factors that influenced the design and outcome.

Chapter 3

Project Brief, Motivation and Approach

3.1 Project brief

The exhibition, entitled "Pyhät ja Pakanat", translating as "The Pious and the Pagans", brought together sculptures of Finnish medieval ecclesiastical origin, and contemporary artistic sculpture for a public display in the medieval Häme Castle in Hämeenlinna. In the juxtaposition of medieval and contemporary work, the curators intended to forge new meanings and understandings of portrayals of humanity—similarities and differences. The contemporary sculptors who exhibited—Mia Hamari, Maija Helasvuo and Tapani Kokko—all used the traditional medium of wood in new and unique ways, which connected to the expert craftsmanship of the older work, and also to the reflection of similar themes of humanity that have transcended the ages: love, birth, motherhood, suffering, death, loss, grief, transience, power and strength. The themes denoted the curation for each room in the exhibition space.

The medieval works that the museum had selected for the theme of power and strength included many sculptural portrayals from the legend of St. George and the Dragon. The central portrayal to be exhibited was a complete medieval work from a church in Sauvo (Fig. 3.1); the work is "complete" as it has all four elements required for the portrayal of the narrative: St. George, who sits atop his horse, Princess Cleolinda kneeling in prayer, and the dragon. In addition to this complete work, the museum had three elements from different, partial works in their own archive—

a sculpture of St. George, a sculpture of a St. George's horse, and a sculpture of Princess Cleolinda (Fig. 3.2); they did not have any dragon as a partial element.

Under the direction of Professor Lily Díaz, the initial project briefing was held at Kansallismuseo (National Museum of Finland), Helsinki, on 19th January 2017, with the exhibition curator, Sanna Teittinen, project historian Jouni Kuurne and 3D-artist Topias Airas from Metropolia University. The brief was to produce a digital reconstruction of St. George and the Dragon based on the partial statues from the museum's collection. The work was to use the original forms of the statues, realized as high-resolution 3D digital models, and then reconstructed to a fully restored medieval aesthetic through a mixture of historical research, conservation research and artistic interpretation. The designed outcome was to illuminate the artistry of the sculptures, and celebrate what they may have appeared like when they were first made, even though the elements were not part of the same set originally. Emphasis on the artistic interpretation was a key goal, in accordance to the overall theme of the exhibition—the curators were very open and enthusiastic to see new ideas, with the proviso that they fit into the context of the exhibition. The museum provided extended information of the context by sharing the visuals from all the work to be displayed, and the spatial and interior designs that had been devised by the architects (colourways, materials, plans).

More practical requirements included an emphasis on family friendliness, accessibility, and a timeline for completion and installation in the museum by the 18th April 2017. This provided approximately 12 weeks of design and production time.

3.2 Background and motivation

> ...all the time we are guided by sensing the presence of a hidden reality toward which our clues are pointing. (Polanyi[1])

My design work is constantly redefining itself. I came to MediaLab with naive intentions to resolve an inner sense of turmoil with regard to my identity as a designer; however, the variety of opportunity and teaching at Aalto has simply resolved my design identity as follows—I am an interdisciplinary designer. My undergraduate studies were also interdisciplinary in nature, concerned with "artefact design", also

[1]Michael Polanyi, *The tacit dimension* (Chicago, IL: The University of Chicago Press, 1966), p. 24.

Figure 3.1: *St. George and the Dragon*, Sauvo Church, c. 1490

(a) *Princess Cleolinda*, Pälkäne church, c. 1500

(b) *St. George (torso)*, Lempäälä church, c. 1510

(c) *St. George's horse*, Nousiainen church, c. 1500

Figure 3.2: The original medieval statues from the museum archives that formed the basis of the digital reconstruction

known as "object" design, which was taught in relation to spatial design and architecture. Throughout my subsequent career, it has been a frustration to explain this as "product" design, which is a term that seems more ubiquitous and understandable to others, but one that does not accurately reflect the fundamental differences in these design disciplines.

Artefact designers are concerned with *the object*, not only *the product*. Artefact design positions itself within a context that is defined by the project at hand; product design positions itself predominantly in the consumerist sphere, with high focus on notions of "the user", "function", "cost" and other such definitions that skew the design process to feed consumer demand. A design approach for *the object* removes any presupposition for what an object should be or who it should serve. Consequently, the design can define itself as many things—both art and design, sculptural and functional, meaningful and entertaining, object and product. The artefact designer is also immersed in material and making—approaches are hands on, experimental, led by sensing qualities that point to a solution,[2] rather than qualitatively achieving goals as one would expect in product design. The designer that best encompasses this notion, in my opinion, is Thomas Heatherwick, who often is often described as both sculptor and architect,[3] and describes his work in terms of objects, scale, material and problem-solving by design.

These object and material sensibilities have, I believe, also been reflected in my interests in media more generally; animation (among many other things) has always been an interest of mine, particularly old stop motion, and 3D animation that have an inherent material quality to them—this started from an enthusiasm for Ray Harryhausen's infamous "dynamation".[4] I am also intrigued by work that brings animation to the physical realm (pervasive animation, kinetic art)—flipbooks, thaumatropes, phenakistoscopes, zoetropes. Some examples can be seen in many recent new media works: Akinori Goto's animations using 3D printed sculptures and lasers;[5] TROPE's *D-Scope*, that choreographs real objects and projection mapping to

[2]Polanyi, *The tacit dimension*, p. 24.

[3]The Royal Academy, "Thomas Heatherwick RA," Accessed November 6, 2017, 2017, `https://www.royalacademy.org.uk/artist/thomas-heatherwick-ra-elect`.

[4]Ray Harryhausen and Tony Dalton, *Ray Harryhausen: an animated life* (London, UK: Aurum Press, 2003).

[5]Akinori Goto, *Energy: sculpture of time*, 2017, Mixed media sculpture; Akinori Goto, *toki-*, 2015, Series of mixed media sculptures.

create immersive animation;[6] the three-dimensional zoetrope sculpture *All Things Fall*, by Mat Collishaw.[7]

During this research, my direction was informed by my interests and design background, through second-nature and tacit knowledge; the inclusion of this short explanation intends to illuminate the sensibilities that were brought to the project from this dimension, just as any other designer would have approached the project in their own unique manner. My motivation was therefore driven by my identity as an interdisciplinary designer—the nature of the exhibition was interdisciplinary, as it combined of medieval art and contemporary sculpture—a concept that piqued my interest. The project itself was a unique opportunity to explore applications of the knowledge I had acquired from my studies at MediaLab, to extend them further during the project, to combine them with previous skills, and to work collaboratively in a professional setting.

3.3 A project-driven method

This research and production was situated in a professional context: a multidisciplinary collaboration with artists and designers from Aalto and Metropolia universities, and museum professionals at Kansallismuseo (National Museum of Finland). My own method aligned itself to a project-driven research method,[8] derived from Findeli,[9] where the designer engages in a dialogue between theory and practice, and is accountable for the outcomes both theoretically and professionally. The project dialogue during the process situated and embedded the theory into the work, and the professional context comprised the research terrain. The application of the method involves the designer raising research questions based on problem areas in the project, that then lead to deliverables such as new approaches and design proposals (Fig. 3.3).

[6]Carol MacGillivray and Bruno Mathez, "Co-authored narrative experience: affective, embodied interaction through combining the diachronic with the synchronistic," *Leonardo electronic almanac* 18, no. 3 (2012).

[7]Mat Collishaw, *All things fall*, 2014, Mixed media art installation.

[8]Lily Díaz-Kommonen, *Art, fact and artifact production* (Helsinki, Finland: Ilmari Design Publications A37, University of Art & Design, 2002).

[9]Alain Findeli, "Will design ever become science? Epistemological and methodological issues in design research, followed by a proposition," in *No guru, no method? Conference proceedings* (Helsinki, Finland: University of Art & Design, UIAH, 1998), 63–69.

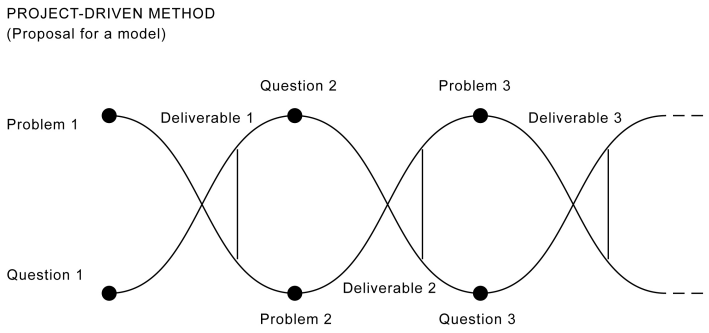


Figure 3.3: Project-driven method[10]

Discussed in Section 2.1 are the problems arising in collaborations between cultural heritage and new media; specifically, the dichotomy between how objects are understood in each field. Principally, the difference is how the two fields deal with time; design and new media pertains to the present, and to the future, whereas cultural heritage pertains to the past. Cultural heritage seeks to illuminate past cultures through material manifestations, whereas design and new media seeks to innovate and create new cultures, reflecting from the present culture in which the object is created. This raised several design research questions:

> *How can a work of new media express sensitivity towards values of material culture?*
>
> *How does the dichotomy of old and new objects manifest in museum spaces?*
>
> *What relevance does this have on the form, material, aesthetic, and other understandings of a media work?*
>
> *What is the wider knowledge that may be useful to the design thinking to resolve the dichotomy?*
>
> *Are there existing design approaches to overcome this?*

It should be understood that the research questions are continual, because the very nature of any problems in collaborative, professional projects are that they are indeterminate. Design research should not be reduced to a science,[11] but embrace the

[10] Díaz-Kommonen, *Art, fact and artifact production*, p. 43.
[11] Ibid.

complexities that are inherent to the field; through continuous questioning and theoretical reflection, new approaches can be fostered.

3.4 Media archaeology and remediation

In the case of this project, the approach to the research was heavily influenced by media archaeology. The aim was not to simply understand the history of a media technology, but the cultures, effects, narratives surrounding them, such as the motivation for their creation, and the cultural desires they created or intended to fulfil. More generally, the research was looking to the past to seek alternatives to the identified problem areas, asking questions such as:

- *What media, relevant to this project, have we lost in history, and why?*
- *How are they relevant today; can they be remediated?*

Old or abandoned ideas are so because of particular reasons at a particular point in time—in another context they may flourish, and so this project sought to remediate these ideas. Another useful concept is that of "imaginary media", influenced by *The Book of Imaginary Media*.[12] The imaginary media can be broken down by Zielinski's[13] categorizations:

- *Untimely media*—devised much too early or much too late, and realized centuries before or after being invented.
- *Conceptual media*— that were devised or sketched, but never realized.
- *Impossible media*—impossible to realize, devised as signifiers rather than actual proposals.

Kluitenberg proposed a notion that all media are accompanied by dreams of what it could be in a future form, which is a powerful imaginary dimension that shapes perceptions and development of media. This concept can be used as a tool to rethink and appropriate media and their institutions.[14]

[12] Kluitenberg, *The book of imaginary media: excavating the dream of the ultimate communication medium*.
[13] Zielinski, "Modelling media for Ignatius Loyola. A case study on Athanasius Kircher's world of apparatus between the imaginary and the real," p. 30.
[14] Gansing, *Transversal media practices: media archaeology, art and technological development*.

Of particular importance in this project was the concept of the "residual",[15] where the processes of standardization and variation push media to near-obsoletion. These media are not "dead", they are residues from earlier media cultures that have since transformed. For example, analogue television, a dominant medium of the 20th century, is a residue of an "undead analogue spectrum that once occupied by a myriad of media operators".[16] Remediation of residual media breaks the associations with their rigid cultural origins and offers possibilities for continual, renewable interpretation.

The following chapters are categorized into two parts: 'Excavation' and 'Intervention'.[17] The excavation presents the media archeology research and surrounding contextual discussions that informed the design thinking, and the resultant outcome for this project. Subsequently, the intervention presents the methods from the design process, the choices and influences in reference to the excavation, and other factors pertaining to collaborative, project-driven research.

My work on the project was not solely to explore the remediation potential of old media, or to renew a specific obsolete device, by inserting the new media into it—both of which position the intervention as discourse within media archaeology itself—rather, the intention was to draw upon aspects of old media, and to reconstruct them into a new form that is specific to the context of public display in a museum. The excavated understandings of the invention, culture, remediation potential and narrative of old media were of importance for the final work to reflect the values of cultural heritage, rather than to reflect the discourse of media archaeology itself.

Summary

This chapter has discussed the brief, and other factors that may have influenced the project, for example, my background as a designer, and the project-driven method which certainly brought many other factors requiring consideration, such as a limited time-frame. Also introduced were other concepts from media archaeology, and remediation, which were used as an approach for the project. As discussed, in order

[15]Charles R. Acland, ed., *Residual media* (Minneapolis, MA: University of Minnesota Press, 2007).
[16]Gansing, *Transversal media practices: media archaeology, art and technological development*, p. 284.
[17]Ibid.

to use media archaeology as an approach to design, the approach can be broadly separated into excavation and intervention phases. Thus an excavation was conducted, the result of which is presented in the following chapter.

Chapter 4

Excavation

The excavation presented here was conducted in order to pinpoint relevant historical information regarding the design, intentions and contexts of old media. To do this, the research was split into four broad themes that were pertinent to the brief: presence, form, scale and motion. Presence is discussed comparatively—to understand the differences between notions of contemporary and historical presence. Following this an investigation of characteristics from particular media devices are discussed to illuminate the understandings that were important in the design decisions for the final outcome.

4.1 Presence, vacancy and space

Presence is a subjective notion, and consequently not an entirely simple term to define—from psychology to philosophy, engineering to the arts, it is used in relation to a wide variety of fields to describe diverse concepts. In the most literal sense, presence refers to the very state of *existence*; however, in new media it typically pertains to the illusory perception that a mediated experience is non-mediated.[1] Presence, in this regard, allows a perceptual experience to feel immediate; the medium erases itself, leaving the user in the presence of the experience. A medium that is designed for this perception is described as being transparent—it is by design that the user's concern is not directed towards the presence of the medium, but rather the presence of the mediated experience:

[1] Lombard and Ditton, "At the heart of it all: the concept of presence."

> Virtual reality, three-dimensional graphics, and graphical interface design are all seeking to make digital technology "transparent"
>
> (Bolter and Grusin[2])

However, even with the above definition, in relation to new media, presence can still be conceptualized in several ways. For example, in a virtual reality experience, presence can be seen as transportation (from the real world to the virtual); as realism (to look and feel like one is present in an alternative "real" environment); or as immersion (the degree to which one feels submerged, engaged or engrossed by the experience).[3]

Presence as transportation appears to be a favoured concept,[4] as it relies on the interwoven notion of environment—both the physical and virtual. To "transport", in this sense, is of course not literal—it is a shift in perception. Therefore, presence is multifaceted because the user may feel present in an alternative environment, whilst still being present in the physical one. The degree to which a user feels present in a virtual environment, and measuring this presence, continues as a key focus of research.[5] However, it should be understood that at no point in the culture of immediacy is it required that the user is entirely fooled by the representation as being real. It is argued that the interplay between believing the reality of the representation, and the delight of knowing the representation is being mediated, is the discrepancy that makes immediacy so compelling to an audience.[6]

With regards to environments: where there is presence, there is also the conflicting characteristic of absence. A transported presence to a virtual environment simultaneously leads to a *present absence* in the physical environment—i.e. a loss of perceptual presence that is discernible by both the user and other observers in the

[2]Bolter and Grusin, *Remediation: understanding new media*, p. 23.

[3]Lombard and Ditton, "At the heart of it all: the concept of presence"; Martijn J. Schuemie et al., "Research on presence in virtual reality: a survey," *Cyberpsychology and behaviour* 4, no. 2 (2001): 183–201.

[4]Schuemie et al., "Research on presence in virtual reality: a survey," p. 184.

[5]Bob G. Witmer and Michael J. Singer, "Measuring presence in virtual environments: a presence questionnaire," *Presence: teleoperators and virtual environments* 7, no. 3 (1998): 225–240; Wijnand A. IJsselsteijn et al., "Presence: concept, determinants and measurement," in *SPIE proceedings series* (Society of Photo-Optical Instrumentation Engineers, 2000), 520–529; Matthew Lombard, Theresa Ditton, and Lisa Weinstein, "Measuring presence: the temple presence inventory," in *Proceedings of the 12th annual international workshop on presence* (International Society for Presence Research, 2009), 1–15.

[6]Tom Gunning, "An aesthetic of astonishment: early film and the (in)credulous spectator," in *Viewing positions: ways of seeing film*, ed. Linda Williams (New Brunswick, NJ: Rutgers University Press, 1995), p. 129.

space. This circumstance has been described as "the vacancy problem":

> ...the noticeable and profound absence of a person from one world, either real or virtual, while they are participating in the other...[is] a fundamental characteristic of today's virtual worlds.
>
> (Lifton and Paradiso[7])

Research into measuring presence cites feedback from the user that the tangible sensation of the headset is a constant reminder that they are tethered by wires to the experience.[8] The fact that users describe their ties to their physical environment means that they are aware that they remain in the physical space—they are perceptually absent but physically present. This can lead to many complex consequences, ranging from motion sickness[9] to fear:

> The results [of refashioning physical experience to VR] can be literally frightening for one class of users, exhilarating for another.
>
> (Bolter and Grusin[10])

Similar concerns are also mirrored in augmented reality, however the transportation is reversed—the virtual is 'present' in the real world. In this case, a viewer's attention must be focused on the medium to perceive the effect, and arguably, this also causes a certain amount of vacancy. Transportation of perceptual presence is additionally related to attention and involvement with the medium.[11] Whilst the user may still feel present in the physical environment, their attention is directed through the transparent medium towards the immediate visually mixed reality.

The historical desire to achieve immediacy culturally drives a common approach to presence that is designed into many common contemporary devices. As discussed in Section 2.1 of this thesis, transparent devices that are used to mediate VR/AR are difficult to naturalize into exhibition spaces. This is, in part, due to their design being

[7] Joshua Lifton and Joseph A. Paradiso, "Dual reality: merging the real and virtual," in *International conference on facets of virtual environments* (Berlin, Germany: Springer, 2009), p. 4.

[8] Phil Turner and Susan Turner, "Place, sense of place, and presence," *Presence: teleoperators and virtual environments* 15, no. 2 (2006): p. 211.

[9] Lawrence J. Hettinger and Gary E. Riccio, "Visually induced motion sickness in virtual environments," *Presence: teleoperators and virtual environments* 1, no. 3 (1992): p. 211.

[10] Bolter and Grusin, *Remediation: understanding new media*, p. 161.

[11] Witmer and Singer, "Measuring presence in virtual environments: a presence questionnaire."

erasive of their presence, and the nature of transporting presence in also fostering absence. However, since transparent immediacy can never truly erase all perceptions of existence in the physical world, it is clear that the media designer can explore whether this approach to presence is necessary at all; transparency is not required for an authenticity of experience.[12] Giving presence to the medium can foster equally engaging media experiences. To do so requires the alternative notion to immediacy: hypermediacy, which "in every manifestation... makes us aware of the medium".[13] Hypermediated representations are processes—they are comprised of a multiplicity of representations that require an oscillating attention from the user. Within a virtual environment, this is evidenced in the multiple windows, icons, buttons that comprise the graphical user interface, and consequently make the user aware that the mediation is occuring. In relation to the physical medium, hypermediation can also been described as the tension between *looking at* and *looking through*.[14] For example, in opposition to the desire of illusions of non-mediation, a commonality of many media archaeological artworks is the deliberate disruption of immediacy to allow the medium to draw attention to itself:

> One of the peculiarities of the media art installation is its Janus-faced character as both an object and a process...the constructed gaze is split between dimensions which [is called] the "outer form" (the spatial, material aspect of the installation) and the "inner form" (the virtual worlds hidden within it). In an archeological artwork, switching between these dimensions, as if constantly changing focus, means alternating between different subject positions, and also "travelling" between the layers of time. (Huhtamo[15])

Media archaeological artworks, by design, direct concern towards the presence of the medium and also towards the presence of what is being mediated—these dimensions comprise the experience, and require a constructed "split" gaze for the

[12] Erkki Huhtamo, "Encapsulated bodies in motion: simulators and the quest for total immersion," in *Critical issues in electronic media*, ed. Simon Penny (Albany, NY: State University of New York Press, 1995), p. 171.

[13] Bolter and Grusin, *Remediation: understanding new media*, p. 34.

[14] Richard A. Lanham, *The electronic word: democracy, technology, and the arts* (Chicago, IL: University of Chicago Press, 1995), p. 5.

[15] Huhtamo, "Time-travelling in the gallery: an archaeological approach in media art," p. 244.

full meaning to be imparted. Consequently, the approach purposefully emphasizes presence in the physical environment by employing the logic of hypermediation to the medium itself.

Hypermediacy is exemplified in historical media, that were often mediated in vast physical spaces, as a means of mass communication. Buildings, such as cathedrals, are themselves media to their own messages; they are hypermediated spaces demonstrative of how space, media and representation are constructed in such a way that guided the congregant's gaze through differing views, scales, experiences, representations, and materials. Additionally objects such as altarpieces were hypermediated by juxtaposing various forms of representation within them—two-dimensional and three-dimensional.[16]

Comparisons can be drawn between the exhibition space, such as a museum, and the hypermediated space, such as a cathedral. With many mediating objects in the same space, the viewer's gaze is temporary; focus can alternate and be shared between objects, or facets of objects, to impart an overall message. In a European cathedral, larger representations, such as stained glass windows, are broken down into smaller representations, for example, depictions of saints. Often these depictions were iconographic, so the same narratives could be remediated in other formats within the space; a clear example of this is the Madonna and Child. The deconstruction of the larger immersive message (in this case, religion), is afforded through constantly alternating the gaze between representations in the space. Equally, an exhibition uses curation to mediate an overall theme or message that is then depicted through the inclusion of related works, and how the works relate to one another. Their collective presence as media within the space is critical to the understanding of the experience overall.

In creating any work of media, then, presence is a significant consideration for the media artist/designer. In frustrating common notions of presence using a media archaeological approach, the media artist/designer can better construct a presence that is conducive to their aims—it should be questioned whether the illusion of non-mediation is necessary. Presence can be constructed much like any other element of a design; it can be analysed, designed and constructed in the same manner as any other designed process, such as in interaction design. Rather than accepting

[16]Bolter and Grusin, *Remediation: understanding new media*, p. 34.

or continuing current notions of presence, such as searching for greater immediacy e.g. the "interfaceless interface",[17] rejection and frustration of immediacy seeks to widen the opportunities for new styles of presence and engagement:

> By moving constantly between past and present [media archaeological artworks] contribute to the formulation of new and hopefully more versatile interfaces... (Huhtamo[18])

4.2 Mediating illusions of form

The stereoscope: how design of a medium affects perception

The stereoscope is a device that is "inseparable from early nineteenth century debates about the perception of space",[19] with historical discourse that is still pertinent to its use in media art today. The first stereoscopic apparatus was demonstrated by English scientist Sir Charles Wheatstone in 1838, consisting of two plane mirrors, at a 90 degree angle to each other, and a 45 degree and to each of the viewer's eyes.

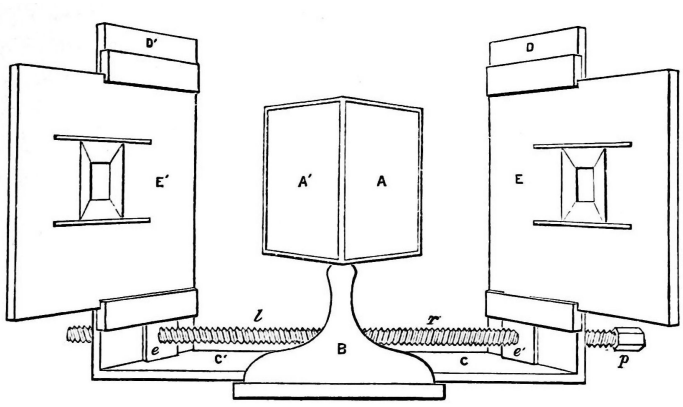


Figure 4.1: An illustration of the Wheatstone (or reflecting) stereoscope[20]

[17] Bolter and Grusin, *Remediation: understanding new media*, p. 23.

[18] Huhtamo, "Time-travelling in the gallery: an archaeological approach in media art," p. 260.

[19] Jonathan Crary, *Techniques of the observer: on vision and modernity in the nineteenth century* (Cambridge, MA: The MIT Press, 1990), p. 118.

[20] Charles Wheatstone, "Contributions to the physiology of vision.–Part the first. On some remarkable, and hitherto unobserved, phenomena of binocular vision," *Philosophical transactions of the Royal Society of London* 128 (1838): p. 371.

[21] Ibid., p. 372.

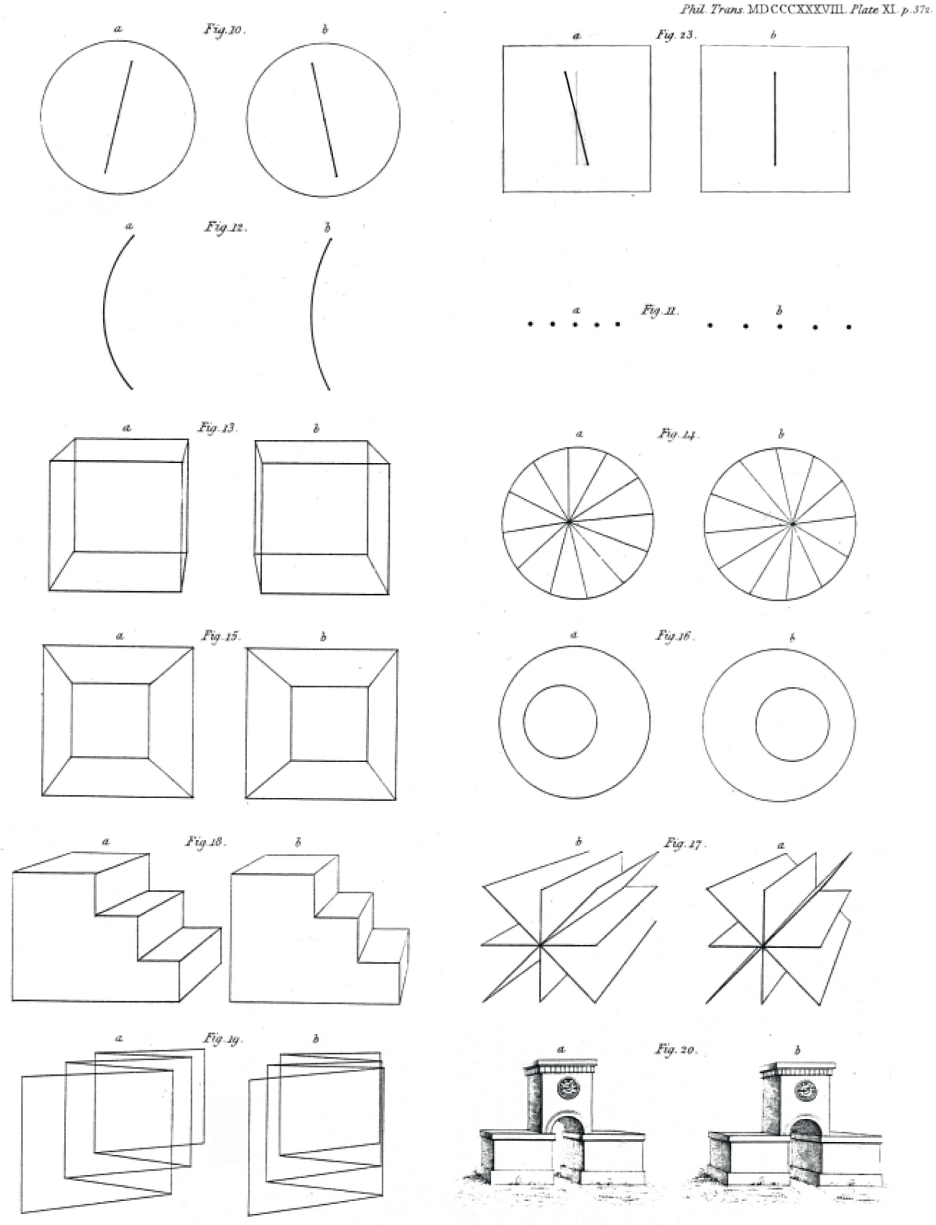


Figure 4.2: Charles Wheatstone's original stereo pairs, 1838[21]

At opposite ends of the apparatus were flat pictures that were reflected in the mirrors, adjustable in position to experiment with varying parameters such as angle and distance (Fig. 4.1).

The design of Wheatstone's apparatus, also known as the mirror or reflecting stereoscope, was one of scientific demonstration—to display and test the effects of the convergence of two individual images. Interestingly, even though the device is commonly at the centre of debates on perceptions of space, Wheatstone's research was more concerned with *the object*. His reasoning for this was, of course, scientific—when looking at a plane of objects at a far distance, due to a small angle of convergence, each eye receives a similar image and therefore limits any three-dimensional effect on convergence. Paintings, then, were an adequate form of representation for distant subjects. However, looking at an object on a much closer plane, the angle of convergence increases, each eye receives a dissimilar image, and the perception of three-dimensions is extremely pronounced on convergence. Wheatstone originated the name "stereoscope" in order "to indicate its property of representing solid figures".[22] Depth and spatial perception mediated through the stereoscope are in relation to the object.

> ...Wheatstone aimed to simulate the actual presence of a physical object, not to discover another way to exhibit a print or drawing. Painting had been an adequate form of representation...but only for images of objects at a great distance. The desired effect of the stereoscope was not simply likeness, but immediate, apparent *tangibility*. (Crary[23])

Wheatstone's research was conducted on the advent of rapid innovations in photography, thus, the first 3D images were pairs of line drawings that had been carefully constructed to mimic an object's projection to each eye (Fig. 4.2). After photographic processes such as the Talbotype and Daguerrotype were devised, the stereoscope rapidly proliferated society. Ambition to spread scientific ideas led to assertions of the stereoscopes suitability to view photographic representations of "living persons, buildings, landscape scenery, and every variety of sculpture".[24] However,

[22]Wheatstone, "Contributions to the physiology of vision I," p. 374.

[23]Crary, *Techniques of the observer: on vision and modernity in the nineteenth century*, p. 122-124.

[24]David Brewster, *The stereoscope; its history, theory, and construction, with its application to the fine and useful arts and to education* (London, UK: John Murray, 1856), p. 29.

this was true only where properties of the image were controlled; the effects were variable, and highly dependant on the composition of the image, which seemed to organize the image in a sequence of receding planes, rather than a blended experience of depth. Any central vanishing point would appear flat, as would some other indicators of volume by light or shade.[25] Wheatstone's initial attestation of the illusions suitability to the near object, remains. The stereoscope, therefore, has continuing relevance for media artists in representations of form, objects and sculpture:

> ... association between sculpture and stereography is perhaps the strongest expression of the way that the phenomenal realism of the device augmented the indexical realism of photography: the stereoscope gave photography a new haptic, material dimension. (Plunkett[26])

Wheatstone's apparatus, however, is not the form of stereoscope typically associated with the name today. The use of lenses to converge the images was the invention of his contemporary and rival, David Brewster, who harshly observed that "the reflecting stereoscope [is] of little service, and ill fitted, not only for popular use, but for the application of the instrument to various useful purposes".[27] Brewster subsequently devised his own "lenticular stereoscope" c. 1844 (Fig. 4.3), employing the use of lenses, the side-by-side format (Fig. 4.4), and the enclosed stereoscope design. He can also somewhat be attributed for the popularization of stereoscopy within art, wider education and entertainment in the nineteenth century.[28]

Through his re-invention, Brewster impacted the relationship between the observer and optical apparatus, and also the wider culture of stereoscopy, as is apparent from its sudden popularity as a means of visual consumption. Precedently, the Wheatstone stereoscope purposefully broke the viewer's mental model of forward binocular vision, to minimize potential argument of falsifying the demonstrated ef-

[25] Crary, *Techniques of the observer: on vision and modernity in the nineteenth century*, p. 124-125.

[26] John Plunkett, "'Feeling Seeing': touch, vision and the stereoscope," *History of photography* 37, no. 4 (2013): p. 396.

[27] Brewster, *The stereoscope; its history, theory, and construction, with its application to the fine and useful arts and to education*, p. 28.

[28] Wheatstone had also explored the opportunity of stereoscopic photography and portraiture (Nicholas J. Wade and Hiroshi Ono, "Early studies of binocular and stereoscopic vision," *Japanese psychological research* 54, no. 1 [2012]: 54–70)—Brewster (*The stereoscope; its history, theory, and construction, with its application to the fine and useful arts and to education*) did not acknowledge this in his written history.

fect, and to "isolate the variable of binocular disparity".[29] It was an apparatus designed for description—an tool for the human eye to experience an illusion disjunct from one's natural understanding of vision.

> ... the [Wheatstone] stereoscope opened a new world for the study of binocular vision. That world was the laboratory, and with the aid of the stereoscope the methods of physics could be applied to the investigation of spatial vision. Wheatstone was able to manipulate the pictures presented to each eye and observe the depth that was produced.
>
> (Wade and Ono[30])

The factual, scientific nature of the apparatus required that it did not disguise the produced hallucinatory, unreal effect.[31] In contrast to this, Brewster's design supported experience of natural vision in its design. The lenticular stereoscope was a subjective tool where, coupled with the user as part of that tool, it became a new form "perfect vision",[32] hiding the physiological roots of the effect, mediating verisimilitude itself. The change in physical design supported the user's mental model of binocular vision, allowing them "to believe that he or she was looking forward at something 'out there'",[33] a technique more profoundly demonstrating depth to the layman. The physical design of the Brewster stereoscope was highly relevant in achieving this perception.

The experience of peering into another space was not exclusive to the stereoscope, but additionally found in other primitive historical closed-box media devices, such as the peepshow.[34] The peepshow was created in various formats of enclosed black boxes with a monocular hole or lens; inside was an illusory image or picture roll—they were often on display at fairgrounds or by travelling showmen (Fig. 4.5) throughout the eighteenth and nineteenth century. However, contrary to Zone's view that the tradition of the peep show continues today through virtual reality and

[29] Laura B. Schiavo, "From phantom image to perfect vision: physiological objects, commercial photography, and the popularization of the stereoscope," in *New media, 1740–1915*, ed. Lisa Gitelman and Geoffrey B. Pingree (Cambridge, MA: The MIT Press, 2003), p. 119.

[30] Wade and Ono, "Early studies of binocular and stereoscopic vision," p. 61.

[31] Crary, *Techniques of the observer: on vision and modernity in the nineteenth century*, p. 129.

[32] Schiavo, "From phantom image to perfect vision: physiological objects, commercial photography, and the popularization of the stereoscope," p. 120.

[33] Crary, *Techniques of the observer: on vision and modernity in the nineteenth century*, p. 129.

[34] Ray Zone, *Stereoscopic cinema and the origins of 3-D film, 1838–1952* (Lexington, KY: The University Press of Kentucky, 2007), p. 20.

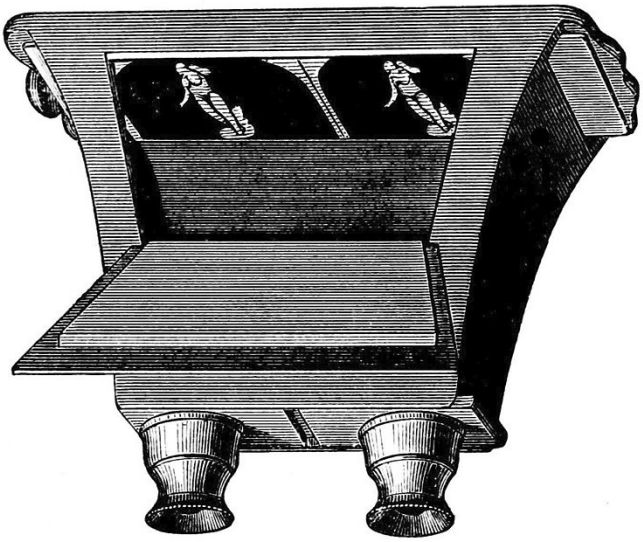


Figure 4.3: An illustration of the Brewster (or lenticular) stereoscope.
W. Le Conte Stevens, "The stereoscope: its history," ed. E. L. Youmans and W. J. Youmans, *The Popular Science Monthly* (New York, NY), 1882, p. 47

Figure 4.4: Stereoscopic daguerreotype of Henry Claudet.
Antoine Claudet, *Stereo-daguerreotype of Henry Claudet*, c. 1853, Stereoscopic Daguerrotype, `https://blog.scienceandmediamuseum.org.uk/wp-content/uploads/2017/03/2-Stereoscopic-daguerreotypes.jpg`, National Science and Media Museum/Science Museum Group collection

head-mounted displays,[35] it should be acknowledged that the experience created by contemporary virtual reality devices centre around notions of immersion, i.e. transporting a participant's presence into a mediated space. Thus immersion, which is fostered by many factors including scale and movement, inherently excludes any experience of separation, or "peep" that was a characteristic of both the stereoscope and the peepshow. This is a fundamental difference, and in this author's opinion, demonstrative of how experience and interpretation is radically altered through seemingly small differences in the mediating device and how it is employed.

The comparison and analysis of these devices of similar illusion but differing participant interpretation makes evident the profound effects the physical format of a medium has on representation as understood by the user. Analysing a physical device through media archaeology excavates the character of a device, and any design aspects that it would afford if used in preference to a contemporary device. These distinctions can be drawn upon by a designer when remediating historical devices: taking characteristics that may have been deemed as undesirable and exploring them once more.

The stereoscope: designing for public engagement

The previous section outlines the relevancy of the stereoscope as a mediating device for illusions of form, and, the important effect of a device's physical format on a user's experience and interpretation. Discussed here are two further stereoscopic devices: the Holmes stereoscope, and the kaiserpanorama. Comparing and analysing the two devices expands the discussion of the physical characteristics of the stereoscope. More specifically, it analyses the cultures that were informing new physical designs to bring the device to much wider audiences, and consequently, how different strategies to reach the public affected the design of the device in relation to physical space.

After the Great Exhibition of 1851, the stereoscope became the first true domestic media machine.[36] The shift in the culture of visual consumption through domestic devices is demonstrated through the design of the Holmes stereoscope. Oliver Wendell Holmes, an American physician and writer with an exuberant enthusiasm

[35] Zone, *Stereoscopic cinema and the origins of 3-D film, 1838–1952*, p. 34.

[36] Erkki Huhtamo, *Illusions in motion: media archaeology of the moving panorama and other related spectacles* (Cambridge, MA: The MIT Press, 2013), p. 190.

for stereoscopy, marketed his redesign of Brewster's model in 1861. He wrote emphatically on the topic, coining the term "stereograph", from the Greek meaning literally to "write with solids",[37] to describe the images that were used in conjunction with the devices. The Holmes stereoscope (Fig. 4.6) was not a technological improvement on Brewster's, it was a redesign of culture and economy—his "inexpensive and open" design[38] became the most widely consumed format of portable stereoscope. Holmes's writing regarding the unique three-dimensional quality of stereoscopy was poetic; he was a natural marketeer:

> We clasp an object with our eyes, as with our arms and hands
>
> (Holmes[39])

Strikingly, however, his writing for the cultural meaning of the stereoscope, particularly pertaining to cultural heritage, juxtaposes uneasily with his literary poeticism:

> Form is henceforth divorced from matter. In fact, matter as a visible object is of no great use any longer. Give us a few negatives of a thing worth seeing, taken from different points of view, and that is all we want of it. Pull it down, or burn it up, if you please....form is cheap and transportable. We have got the fruit of creation now, and need not trouble ourselves with the core. Men will hunt all curious, beautiful, grand, objects, as they hunt the cattle in South America, for their skins, and leave the carcasses of little worth. (Holmes[40])

This cultural meaning of form was in contrast to Wheatstone, who was seeking "equivalence of stereoscopic image and object",[41] rather than the "[triumph] over earthly conditions"[42] Holmes was heralding. However, aspects of Holmes's writing do mirror contemporary digital culture, such as the use of personal devices for the democratization of knowledge, thus the need for a design that was small, cheap and

[37] Zone, *Stereoscopic cinema and the origins of 3-D film, 1838–1952*, p. 12.
[38] Ibid.
[39] Oliver Wendell Holmes, "The stereoscope and the stereograph, 1859," chap. 2 in *Classic Essays on Photography*, ed. Alan Trachtenberg (Sedgwick, ME: Leete's Island Books, 1980), p. 75.
[40] Ibid., p. 80-81.
[41] Crary, *Techniques of the observer: on vision and modernity in the nineteenth century*, p. 122-124.
[42] Holmes, "The stereoscope and the stereograph, 1859," p. 80.

Figure 4.5: *La Lanterna Magica (The Magic Lantern)*, Barolomeo Pinelli, etching. Courtesy of Princeton University Library.

Barolomeo Pinelli, *La lanterna magica*, 1815, Etching, `https://www.princeton.edu/~graphicarts/2012/02/la_lanterna_magica.html`, Italian Prints Collection (GC094), Graphic Arts Collection, Department of Rare Books and Special Collections, Princeton University Library

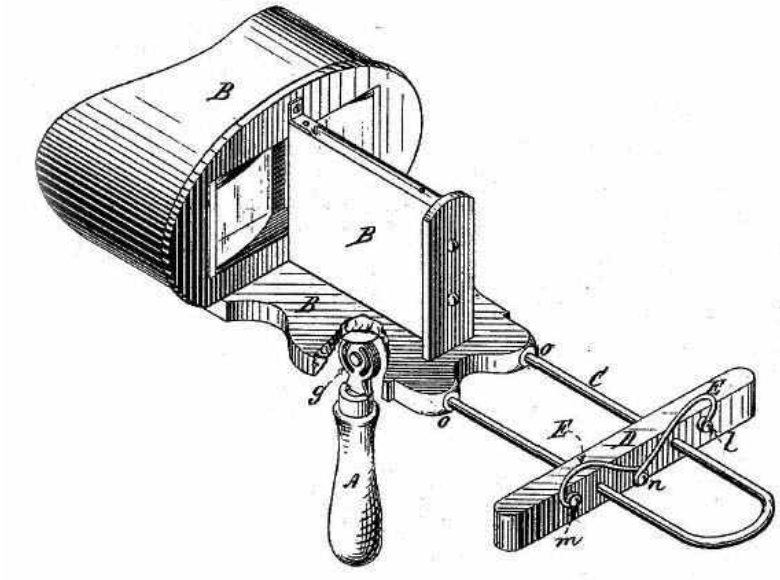


Figure 4.6: A variant of the Holmes stereoscope.

John Pagliughi and John Ardito, Stereoscope, `http://pdfpiw.uspto.gov/.piw?Docid=00232649` (U.S. patent 232,649, filed July 2, 1880, and issued September 28, 1880)

affordable for the masses. Within the last few years, developments such as Google Cardboard and open source photogrammetry software, means that the Internet will likely serve as the stereoscopic library Holmes was advocating, albeit less systematic, as content and the collection of form is also becoming democratized. Thus, where there is no curatorial body, the public are now their own authors of "things worth seeing".[43]

The kaiserpanorama was a device designed with an alternative strategy to the Holmes stereoscope; it served as both a curatorial/educational body and public attraction for the display three-dimensional images to wider audiences. It was first exhibited in 1880 in Breslau by the German inventor August Fuhrmann. Fuhrmann eventually installed the device in 250 cities around the world, simultaneously founding his Central Institute for the Kaiserpanorama, to collect and curate the glass stereographs for the purpose of wider public education; the archive was purported to be over 100,000 images strong,[44] however little physical evidence of this remains.

Due to this distinct difference in strategy, the kaiserpanorama industrialized visual consumption; the design was "a large scale multiviewer of the enclosed Brewster-model",[45] with some variants of the device being able to entertain up to twenty-five participants at once (Fig. 4.7). Its uniqueness was its "specific conception of how an audience could be organized in terms of an individual machinic engagement",[46] displaying a long sequence of images at intervals of roughly two minutes, contrary to the domesticity of Holmes's design that is comparable to contemporary head-mounted displays. Holmes's model, in its separation from curatorial control over content, was partly a contributing factor to its beginning decline in popularity towards the end of the nineteenth century, as conservative Victorian society saw the device synonymous with indecent imagery.[47]

The kaiserpanorama received audiences up until 1939,[48] with changing exhibitions of images from varying countries, offering stereoscopic art for cultural learn-

[43]Holmes, "The stereoscope and the stereograph, 1859," p. 80.

[44]August Fuhrmann, "Forward to The Golden Book for the Central Institute for Kaiser-Panorama" [Goldenes Buch der Zentrale für Kaiserpanoramen], Accessed December 20, 2017, n.d. `http://www.aiq.talktalk.net/3D/kaiserpanorama%5C%20Golden%5C%20book%5C%20EN.htm`.

[45]Jonathan Crary, *Suspensions of perception: attention, spectacle, and modern culture* (Cambridge, MA: The MIT Press, 2001), p. 134.

[46]Ibid.

[47]Crary, *Techniques of the observer: on vision and modernity in the nineteenth century*, p. 29.

[48]Stephan Oettermann, *The panorama: history of a mass medium* [Das Panorama. Die Geschichte eines Massenmediums], trans. Deborah Lucas Schneider (New York, NY: Zone Books, 1997), p. 230.

ing.[49] It is also important to note that it was not a panorama in the traditional understanding; rather than the user being central to the space looking outward for immersive effect, it inverted the spatial relationship, keeping the user inward facing, common to the peepshow style. Its functioning held attention by a rhythmic changing focus between images; it was a mechanical hypermediated experience, where the user was presented an immediate view of a parallel space, but simultaneously a hyper-awareness for the passing of time and lack of autonomy in the experience:

> Whatever subjective psychological investment is in play...it is inseparable from the machinic tempo within which the idea of switching attention must seem necessary and inevitable. (Crary[50])

However, its large room-scale design made it victim to competition of other mass media such as the cinema—and thus, a unique alternative of how stereoscopy can be used in an exhibition space (and as an exhibit itself), consigned to history. In academia, it is considered simply a multiviewer variant of other models, such as Brewster's, that fit more literally into the history of virtual reality.[51] Yet, this device, whilst not unique in its illusion, was a very successful combination of curation, public exhibition of culture and heritage, and 3D visual representation. It is an entirely relevant media arrangement for examining the relationship of stereoscopy and public exhibition within the cultural heritage sector—after all, that is the exact context for which it was created originally. Fuhrmann was clearly addressing the same problems in the nineteenth century, as we continue to see today—the individual domestic device is not an easy format to integrate into the concept of the exhibition. These parallels demonstrate the importance of questioning common devices as the only options for virtual reality or augmented reality.

4.3 Illusions of scale, perspective and position

Any three-dimensional object or form that is realized on a two-dimensional plane will, to some extent, require an illusion to enable an audience to perceive its depth. In the previous section (4.2), the stereoscope is examined as a medium to represent

[49] Fuhrmann, "Forward to The Golden Book for the Central Institute for Kaiser-Panorama."
[50] Crary, *Suspensions of perception: attention, spectacle, and modern culture*, p. 138.
[51] Ibid., p. 136.

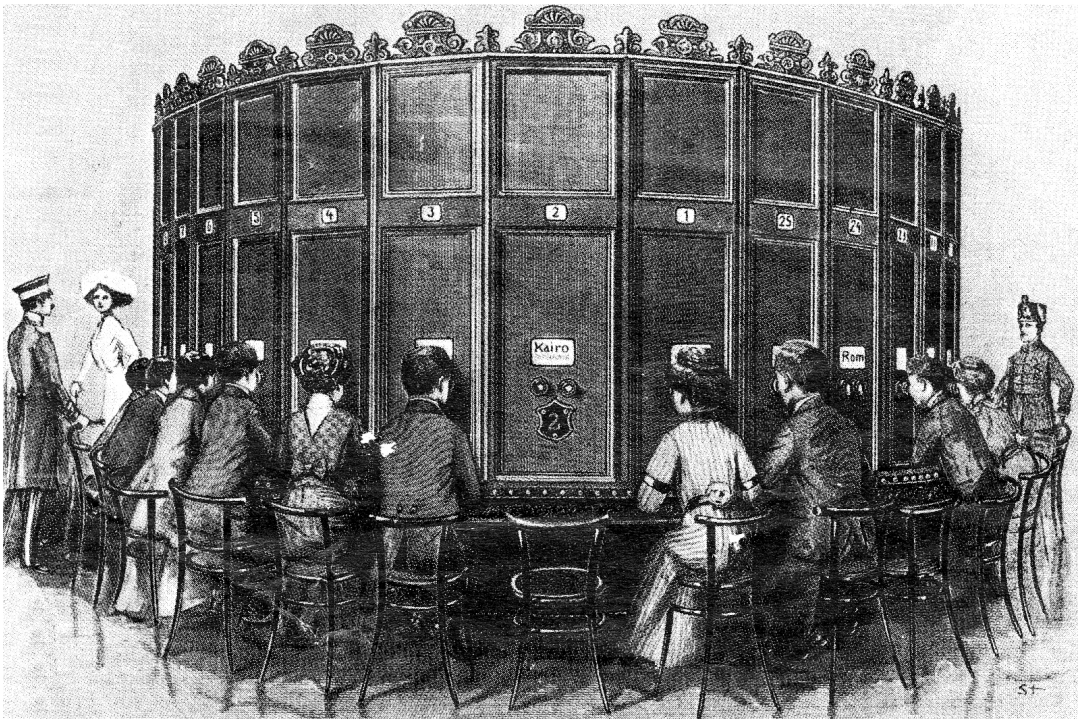


Figure 4.7: Illustration of the kaiserpanorama, c. 1880.
Bernard Comment, *The panorama*, trans. Anne-Marie Glasheen (London, UK: Reaktion Books, 1999), p. 70

three-dimensional form through binocular side-by-side images using either mirrors or lenses to create the illusion of depth. This perceptual characteristic of human vision is the underlying principle of contemporary virtual reality and emergent augmented reality technologies.

However, using the stereoscopic illusion alone does not entirely define the character of the representation; for example, the Brewster stereoscope was interpreted by audiences as "peeping" into another space, whereas virtual reality is designed to "transport" an audience presence to another space entirely. These varying interpretations of the same visual illusion are therefore being affected by other factors of the medium, such as the design of the device itself, and the relationship of the representation to the audience and their environment.

Additionally, the use of particular devices will dictate certain qualities that a media artist must consider. For example, the emergent Microsoft Hololens, is a stereoscopic augmented reality—it allows stereoscopy to visually relate to the physical environment. However it is similar to virtual reality in that it is a head-mounted display, and thus in an exhibition context there are already certain connotations that are inherent to the device. For example, the device is a transparent medium overtly relating to futuristic narrative—as an emergent technology, it references the hologram, a term used to describe illusory immaterial objects. Yet, as also discussed previously, acknowledging physical materiality in representation supports a digital 3D artwork as present in, not subordinate to, the material environment.

Therefore, this section studies alternatives to contemporary media, with a particular focus on how, historically, the representations related to their environment through material means, and created similar illusions of depth, augmentation or immersion. In doing so, it is possible to reference the techniques of these historical media, and remediate them into new installation designs.

Trompe l'oeil: painted augmented reality

> A work of the trompe-l'oeil type, by penetrating the space of the viewer, and making him treat it as part of his own reality, allows him to participate in the past. (Salwa[52])

[52]Mateusz Salwa, *Illusions in painting: an attempt at philosophical interpretation*, trans. Katarzyna Pisarek, vol. 2, Modernity in question, studies in philosophy and history of ideas (Frankfurt, Germany: Peter Lang Edition, 2013), p. 53-54.

Prior to the invention of the stereoscope, varying techniques were widespread to produce convincing effects of depth through illusion. In painting, trompe l'oeil, translating as "to deceive the eye", were illusionistic painting techniques employing tricks of scale, perspective and position to produce effects of depth.

Generally, any illusionistic painting deceives temporarily, on first impression only;[53] nevertheless, when employed in new contexts, with fresh subject matter, basic techniques can still captivate contemporary audiences.[54] However, as with any technological development, our understanding and appreciation of such three-dimensional techniques, in their historical form, diminishes over time:

> It is difficult for modern eyes, long since overexposed to every possible perspective trompe l'oeil sensation from 3-D Cineramas to Disneyland holographic ghosts, to be thrilled again by Renaissance-style demonstrations of perspective "realism". (Edgerton[55])

Trompe l'oeil can be likened to historical augmented reality—they create the illusion of an object or space within the viewer's physical environment. Contrasting technological augmentation, they are a fixed augmented reality, in that they are both permanently augmenting the material environment, and that usually they "unify the composition according to a single vantage point".[56]

The term itself was coined around 1800 to describe illusionistic still life paintings, but is now used in a much wider sense to include illusionistic wall painting, such as Italian Baroque "quadratura" on cathedral ceilings. Arguably the greatest example of a quadratura fresco is "Apotheosis of St. Ignatius" by Andrea Pozzo (1688-94) (Fig. 4.8). Pozzo mimics the three-dimensional architectural forms, such as columns and arches, in the painting, and extends them in his representation thus augmenting the ceiling from a curved surface to an architecture reaching into the heavens. In

[53] Catherine Parayre, "Panoramic trompe-l'oeil: cétait toute une vie by François Bon," in *Disguise, deception, trompe-l'oeil: interdisciplinary perspectives*, ed. Leslie Boldt-Irons, Corrado Federici, and Ernesto Virgulti, vol. 99, Studies on themes and motifs in literature (Frankfurt, Germany: Peter Lang Publishing, 2008), p. 107.

[54] Hannah Ellis-Petersen, "Banksy Brexit mural of man chipping away at EU flag appears in Dover," `https://www.theguardian.com/artanddesign/2017/may/07/banksy-brexit-mural-dover-eu-flag`, *The Guardian*, May 2017.

[55] Samuel Y. Edgerton, *The mirror, the window and the telescope: how renaissance linear perspective changed our vision of the universe* (New York, NY: Cornell University Press, 2009), p. 6.

[56] Alberto Pérez-Gómez and Louise Pelletier, *Architectural representation and the perspective hinge* (Cambridge, MA: The MIT Press, 2000), p. 161.

Figure 4.8: *Apotheosis of St. Ignatius* by Andrea Pozzo. A still frame from a 360-degree photograph from inside Sant'Ignazio, Rome.
Madej, *Inside Sant'Ignazio*

order for it to be successful, the technique requires extreme perspective to create the illusion of height, as viewed from a standing position (which in this example is marked on the cathedral floor[57]) looking up towards the ceiling. Standing elsewhere, the illusion is disordered, or cannot be seen. The scale on the outer edges of the painting, of course, starts at a 1:1 scale to match the building, before being painted as one would expect to perceive the linear perspective from that vantage point:

> When this pictorial space is plausibly related in scale and motif to the actual space of the viewer, a spatial illusion is created.
>
> (Ebert-Schifferer[58])

If employed correctly, the technical illusion will create an accurate spatial illusion; however it is interesting to note that the "realness" of the illusion relies also upon skillful mimicry of the material in the representation, matching the architectural rendering with the physical space:

> An illusionistic painting, made of physical components, tries to capture not just the appearance of objects, but also the rest of their qualities—their softness, hardness, weight, and texture. The better rendered their sensual properties, both primary and secondary, the more complete the illusion, the more clearly the objects "step out" from the painting. Only by "endowing" the painting with all the characteristics known to the viewer from reality is it possible to enable the viewer to "penetrate" into the space of the picture, and the painted objects into the space of the beholder. (Salwa[59])

This is still a common problem with technological augmentation; real-time rendering of material and lighting that match the environment conditions convincingly is still in its infancy,[60] therefore, by carefully controlling the viewpoint and condi-

[57] Szymon Madej, *Inside Sant'Ignazio, the Baroque church in Rome, dedicated to St. Ignatius of Loyola (1491-1556)*, 2011, 360-degree digital photograph, `http://panoramy.zbooy.pl/360/show.html?p=rzym-kosciol-sant-ignazio-wnetrze&lang=e`.

[58] Sybille Ebert-Schifferer, "Trompe l'oeil: the underestimated trick," in *Deceptions and illusions: five centuries of trompe l'oeil painting*, ed. Sybille Ebert-Schifferer (Washington, DC: National Gallery of Art, 2002), p. 21-22.

[59] Salwa, *Illusions in painting: an attempt at philosophical interpretation*, p. 101.

[60] Divya Kamboj, Wankui Liu, and Neetika Gupta, "A review on illumination techniques in augmented reality," in *2013 fourth international conference on computing, communications and networking technologies (ICCCNT)* (July 2013), 1–9.

tions within the space, these illusions can be achieved through alternative means. However, even though realistic material mimicry supports a complete illusion, the true purpose of trompe l'oeil is to make the juxtaposition, between real and representation, meaningful. As art, trompe l'oeil is "a genre of painting in which its self presentation takes place—the painting not only represents what it represents, but also that it represents".[61] For the illusion to achieve both, it requires an active attitude from the viewer,[62] urging "the spectator to look critically at the artwork, bearing in mind it is not reality and that it offers only one of many perspectives".[63]

Trompe l'oeil such as quadratura, then, should be viewed as a transparent medium[64] within a hypermediated space. It is intended to be seen as connected to its surroundings, but questioned as to why it represents what it does.[65] It relies on, and is supported by its environment, and only in existing in location does it achieve meaning. Of course, this characteristic is also apparent for emergent technologies such as virtual reality used in a physical environment built to match the virtual space,[66] and augmented reality implemented for specific real-world spaces (Lumin[67]).

Early Panorama: painted virtual reality

If trompe l'oeil is a historical augmented reality, then the emergence of the nineteenth century panorama can be considered as historical virtual reality.

According to Grau,[68] the panorama drew upon the tradition of Baroque ceiling frescoes such as "quadratura". Fuelled by growing understanding and implementations of mathematical perspective, experimentation with the relationship between scale, space and representation was underpinned by a wider culture of exploration in art, science and mathematics. Painting had been explored through the frame of the canvas, through architectonic framing, and in the case of the panorama, beyond any framing at all. This was achieved by creating seamless, large format cylindrical

[61] Salwa, *Illusions in painting: an attempt at philosophical interpretation*, p. 60.

[62] Marie-Louise D'Otrange Mastai, *Illusion in art: trompe l'oeil: a history of pictorial illusionism* (Norwalk, CT: Abaris Books, 1975), p. 8.

[63] Parayre, "Panoramic trompe-l'oeil: cétait toute une vie by François Bon," p. 107.

[64] Bolter and Grusin, *Remediation: understanding new media*, p. 25.

[65] Salwa, *Illusions in painting: an attempt at philosophical interpretation*, p. 159.

[66] See D. Roth et al., "Social augmentations in multi-user virtual reality: a virtual museum experience," in *2017 IEEE international symposium on mixed and augmented reality* (IEEE, October 2017), 42–43; Collishaw, *Thresholds*.

[67] Detroit Institute of Arts, *Lumin*.

[68] Oliver Grau, *Virtual art: from illusion to immersion* (Cambridge, MA: The MIT press, 2003), p. 52.

paintings that enveloped the viewer in 360 degrees—a technique developed by self-taught artist, Robert Barker in the mid-1700s.[69] The scale required for immersive illusion was so large that, in 1793, Barker and his son erected the first permanent purpose-built rotunda to exhibit the paintings in Leicester Square, London (Fig. 4.9).

Whilst implementation on a large scale was a similarity between the quadratura and panorama, Oettermann[70] suggests that panoramas "honor the tradition more in the breach than in the observance". As discussed, a quadratura was an illusion based on linear perspective, visible from a single viewing point. The constraint of the fixed viewpoint was the artist's tool to guiding the viewer's gaze; however, it had a strong cultural association with religious imagery, i.e. moving the gaze "towards the heavens", and additionally, with limiting those who could view the illusion. For example, in continental Baroque theatres, the viewing point for the central perspective of the set could only be observed from the seat of the sovereign, all other audience would have some type of distortion.[71]

Oettermann thus describes the development of the panorama as divergence from the tradition—a "democratization" of the audience's point of view, as new audiences from the growing middle classes demanded that each viewer be equal.[72] Barker's contribution was multiperspective painting: flat images are drawn with linear perspective of each section of the scene. They are then "stitched" together side by side and adjusted to fix curvature errors due to display in the cylindrical format. Through this method, the panorama could be viewed by all audience members equally at any one time. Therefore, the panorama became a secular, democratic exhibition space, and as such "represents the first true visual mass medium".[73]

Moreover, what can be understood from this history are the cultural differences associated with experiencing 360 degree immersion today. Panoramas were developed to provide infinite viewing points to large collective audiences (due to audience demand and economic requirement); however, in combining this with stereoscopy, a VR headset displays the panoramic view for the individual only; thus, contemporary virtual reality has shed past cultures of collective experience from the panorama. Digital space is easy to construct, and cheap to distribute to small do-

[69] Oettermann, *The panorama: history of a mass medium*, p. 99-108.
[70] Ibid., p. 22.
[71] Ibid., p. 24.
[72] Ibid., p. 25.
[73] Ibid., p. 7.

mestic devices; the challenge for the media artist is thus to remediate digital objects and space within a physical environment, such as an exhibition.

Effect of scale on stereoscopic perception

The beginnings of immersive media can be attributed to the development of multi-perspective techniques, a realistic physical scale, and placing the viewer in the centre of the representation, as implemented in historical painted panorama. Crary[74] pinpoints the panorama as an important part of the modernization of perception—a new construction of optical experience which permanently activated the optical periphery. Conversely, he pinpoints the stereoscope as "a rival (or complementary) model of visual consumption" through the exclusion of the periphery and illusory effect occurring at, and barely beyond, the optical centre.[75] Therefore, the illusion in early stereoscopes excluded any immersive effect, in part, due to the very nature of converging two images into one, which required a central focus. However, there is a much more apparent reason for historical stereoscopy lacking immersion: scale. To be more precise, scale as apprehended by the viewer.

The handheld scale, or closed-box design of the device, is a referent to the size of representation in the immediate perception of the viewer; this is due to the body providing the primary means of discerning scale.[76] Compounding this perception was the nature of the imagery on the stereocards themselves, as scenes were shown in their entirety—full interiors, whole scenes and figures. Thus, a viewer's unconscious empirical knowledge of perspective also signifies the representation as "miniature", and possibly even "far away". On the perceived effects of his own stereoscope, Holmes remarked:

> Many persons suppose that they are looking on miniatures of the objects represented, when they see them in the stereoscope.
>
> (Holmes[77])

The technical illusion of three-dimensionality, then, was not an isolated cause for the stereoscope's nineteenth-century popularity. It appears that the interpreted

[74] Crary, *Suspensions of perception: attention, spectacle, and modern culture*, p. 295.
[75] Ibid., p. 295.
[76] Susan Stewart, *On longing: narratives of the miniature, the gigantic, the souvenir, the collection* (Durham, NC: Duke University Press, 1993), p. 101.
[77] Holmes, "The stereoscope and the stereograph, 1859," p. 78.

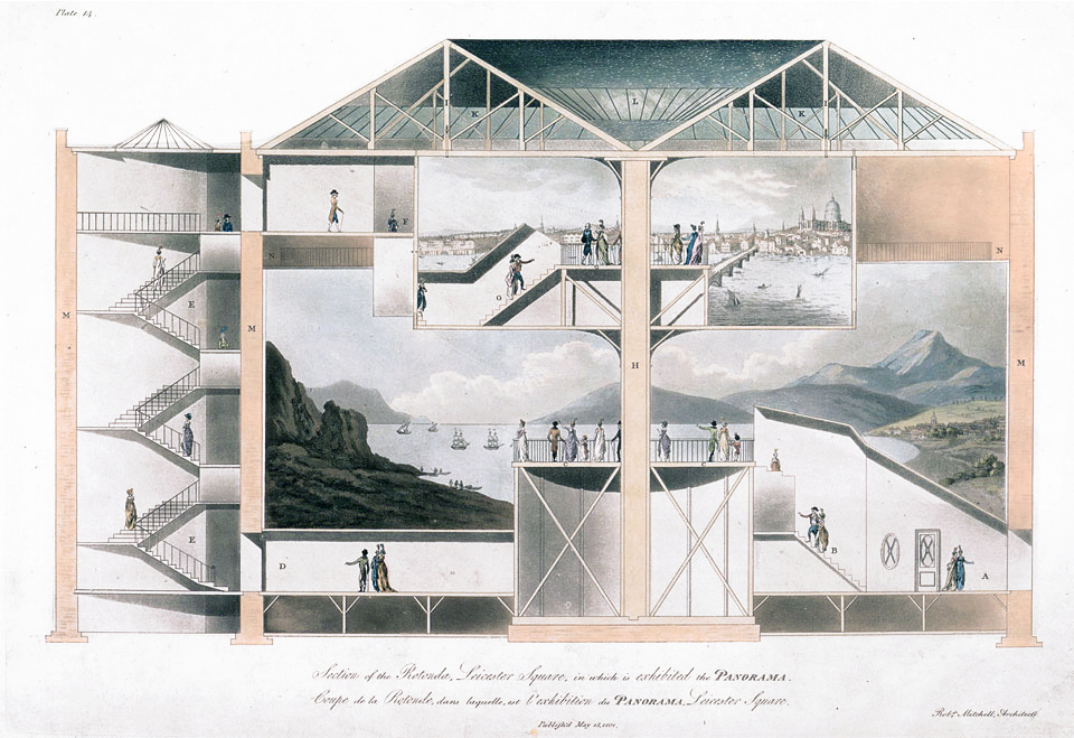


Figure 4.9: Cross-section of the rotunda in Leicester Square.
Mitchell, *Section of the rotunda, Leicester Square, in which is exhibited the panorama, plate 14*

scale, and the object or scene represented, in conjunction with the illusion, was highly significant. Initial audiences were captivated by the experience of cradling wonders of immense scale in the palms of their hands.[78] Again, this is demonstrated through Sala's journalistic account in 1859:

> It is very good, I think, to look on marvellous transcripts of nature, to peep through two little holes at a scrap of cardboard, and say: There are the Grand Mulets, there is the Court of Lions, there is the Alameda of Seville, not to have seen which is not to have seen a wonder.
>
> (Wood[79])

In this way, the stereoscopic experience transcended reality, even though it was comprised of it—the material, the subject, the scale. The use of the stereoscope was an opposite endeavour to the quest for immersion that we see guiding developments in virtual reality today. Developments in contemporary stereoscopic technology contribute to the convincing immersion experienced; improvements such as refined lense manufacture and increased field of view. Furthermore, improvements in technology such as real-time interaction and 3D graphics allow for immersive spatial experience; deductions of scale are fostered also through natural inclination of movement. A virtual reality device today allows the full 360 degree scene to be surveyed by turning the head and movement in the scene. Interestingly, this is reminiscent of Barker's historic intentions for the circular panorama. Movement, and audience arrangement, are therefore other principal factors contributing to perception in a media art installation, as explored further in the next section.

4.4 Motion, sequence and audience arrangement

The effects of motion on representations of depth

Motion is a fundamental part of visual perception, and markedly so in the representation of three-dimensional form. We have discussed the stereoscope as a medium

[78] Sheenagh Pietrobruno, "The stereoscope and the miniature," *Early popular visual culture* 9, no. 3 (2011): 171–190.

[79] R. D. Wood, "The old cap anew: commonplace marvels of photography in the 1850s," *Professional photographer* 32, no. 12 (1992): 14.

for perceiving depth and form through the imitation of stereopsis of natural binocular vision i.e. the triangulation of an object from two eyes spaced apart by the recognition of visual differences. However, a more rudimentary form of depth perception is, in fact, "depth from motion" (or alternatively "structure from motion"), that is induced by observed motion.[80] It is thought to have been the first depth cue to evolve.[81] Another example of the effect of motion on depth perception is "motion parallax",[82] where the near-field will appear to move faster than those in the far distance. This perception is exaggerated in certain observational situations, such as observing a view from the window of a moving train.

Many animals lacking binocular vision are accustomed to perceiving their environment in three dimensions mainly through the differences they observe in how things move, rather than how they appear statically.[83] In humans, these effects complement binocular vision; changes are more pronounced when they are moving, and more easily detected by eye. Even three-dimensional objects can be perceived more easily in three dimensions when they are moving, than when they are static—a principle that underlies many artistic effects such as 3D gestalt illusionism.[84] Depth from motion, and motion parallax, are therefore techniques to create depth cues that can be employed to support the representation of three-dimensional objects, both digital and physical. The use of motion is a principal distinction between an historical device such as the stereoscope, and a virtual reality headset, in the representation of depth. Motion is a key facet in the three-dimensional illusion, implicated in the creation of a more natural imitation of depth.

Additionally, illusions of motion are, of course, the foundational technique of most contemporary visual media. From film and animation to interactive computer interfaces, the illusion of apparent motion—images displayed in quick succession—underpins the experience. The sophistication of these techniques are now so imperceptible that the the present-day audience is no longer conscious of the achievement

[80] Richard A. Andersen and David C. Bradley, "Perception of three-dimensional structure from motion," *Trends in cognitive sciences* 2, no. 6 (1998): 222–228.

[81] Ibid.

[82] Mark Wexler and Jeroen J.A. van Boxtel, "Early studies of binocular and stereoscopic vision," *Trends in cognitive sciences* 9, no. 9 (2005): 431–438; Brian Rogers and Maureen Graham, "Motion parallax as an independent cue for depth perception," *Perception* 8, no. 2 (1979): 125–134.

[83] Irvin Rock, *Indirect perception* (Cambridge, MA: The MIT Press, 1997).

[84] Cheryl Akner-Koler, *Form & formlessness: questioning aesthetic abstractions through art projects, cross-disciplinary studies and product design education* (Stockholm, Sweden: Axl Books, 2007), p. 56.

of the illusion itself, but rather the representations or narratives that are portrayed. Apparent motion in new media is now the result of intangible pulses and signals of computer hardware. However, studying these illusions in their primitive formats highlights their materiality—we see how motion, movement, interaction, time, sequence and audience arrangement were, historically, tightly interwoven. Parikka,[85] for example, argues that these historical media are better studied as objects of interactivity, or gaming, rather than simply the historical background of film and cinema, as the movement of the device was not only serving the illusion, but also defining the experience.

Media of apparent motion, such as the phenakistoscope (Fig. 4.10), the zoetrope (Fig. 4.11), and the mutoscope (Fig. 4.12), were based in a wider synaesthetic experience—one that cannot be reduced only to visual illusion. In a zoetrope, the viewer had control of the speed and direction of the rotation as they spun the device; in the hand-cranked mutoscope, the viewer could interrupt the experience at any point to observe a particular frame.[86] A common factor in all of these media is, therefore, the restriction of timing as an artistic input, and the lack of linear narrative—unlike both film and animation today. Instead, timing was entirely linked to mechanical movement, and narrative was a loop structure of very simple gestures. Loop structures and limited timelines were defined largely in the form of the device, as early machines used machinic loops of some kind to facilitate the illusion. The zoetrope was a spinning cylinder with an internal band of image frames that created a proportional relationship between time, speed and physical size of the medium. Its construction forced a looped timeline of 1–2 seconds in length, but allowed for many observers at once, and also interaction, for instance, simple replacement of the frame sequence. A mutoscope, however, used a cylinder of printed image frames, operating much like a flipbook when rotated. This minimally extended the timeline of the loop, but limited the audience to a single viewer only, and generally dedicated the machine to one set of images. This comparison serves to highlight the intricate nature of constructing these illusions, the impact of media form on the experience, and the resultant effects on the viewing experience.

[85] Parikka, *What is media archaeology?*, p. 28.

[86] Erkki Huhtamo, "Slots of fun, slots of trouble: an archaeology of arcade gaming," in *Handbook of computer game studies*, ed. Joost Raessens and Jeffrey H. Goldstein (Cambridge, MA: The MIT Press, 2005), p. 9.

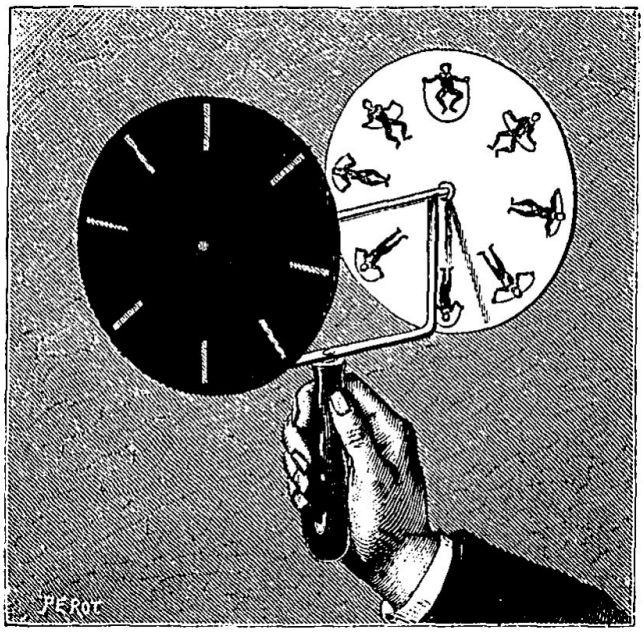


Figure 4.10: An illustration of the phenakistoscope[87]

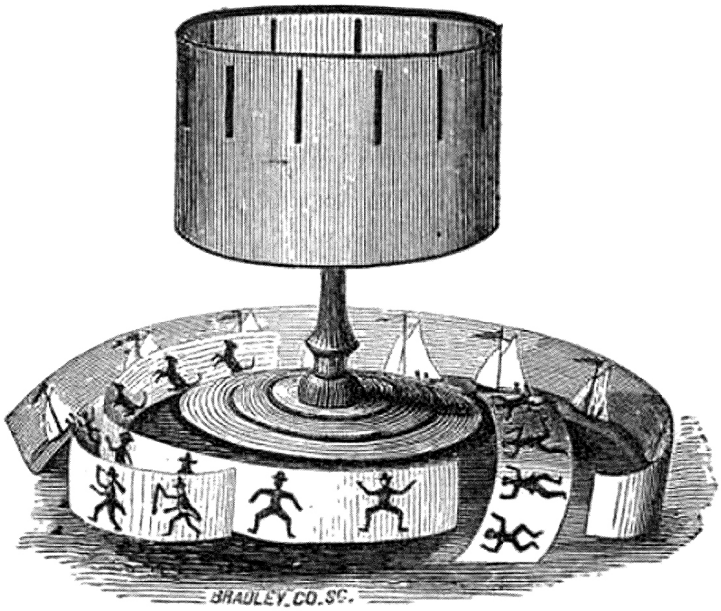


Figure 4.11: An illustration of the zoetrope, 1887[88]

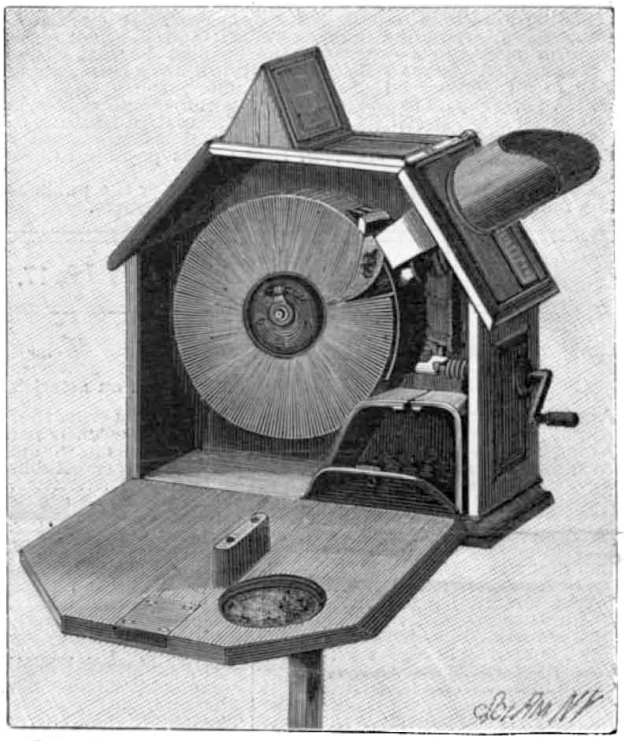


Figure 4.12: An illustration of the mutoscope[89]

Evidently then, motion is an important factor of any medium, and particularly in representations of depth and three dimensions. The following sections of media archaeological excavations are therefore studies of historical media that combine three-dimensional representation and apparent motion as a source of inspiration for new representations of three-dimensional form.

Three dimensions in the zoetrope

One of the most interesting examples of three-dimensions and motion from the nineteenth century was also the work of a scientist, albeit one with a distinctive graphical and visual approach. Étienne-Jules Marey (1830–1904), was a physiologist with

[87]Gaston Tissandier, *Les récréations scientifiques, ou l'enseignement par les jeux* [Scientific recreations, or teaching by games], 3rd ed. (Paris, France: G. Masson, 1883), p. 120.

[88]James W. Queen & Company and D. J. Warner, "The Queen catalogues," vol. 1 (1887; Reprint, San Francisco, CA: Norman Publishing, 1993), p. 4.

[89]Orson Desaix Munn, ed., "The art of moving photography," *Scientific American* (New York, NY) 76, no. 16 (1897): p. 241.

a core interest in movement.[90] He studied the movement of people and animals from a mechanical angle, seeking to explain physiology through proven physical laws. In the approach to his research, Marey used and invented many visual instruments to study movement, for example, he was an early pioneer of the techniques of chronophotography, adapting it to record overlapping poses as sequences of movement within a single frame. Marey, also was highly concerned with the combination of three-dimensions and movement, as he found two dimensional representation limiting for accurate portrayal of movement.[91]

Marey identified that recorded sequences used in conjunction with a zoetrope would demonstrate true movement. In 1887, Marey produced a three-dimensional zoetrope to depict physiological movement. Based on one of his chronophotographic sequences, Marey fabricated and mounted eleven statuettes of a seagull depicting eleven stages of flight inside a zoetrope (Fig. 4.13)—one of the first true three-dimen-

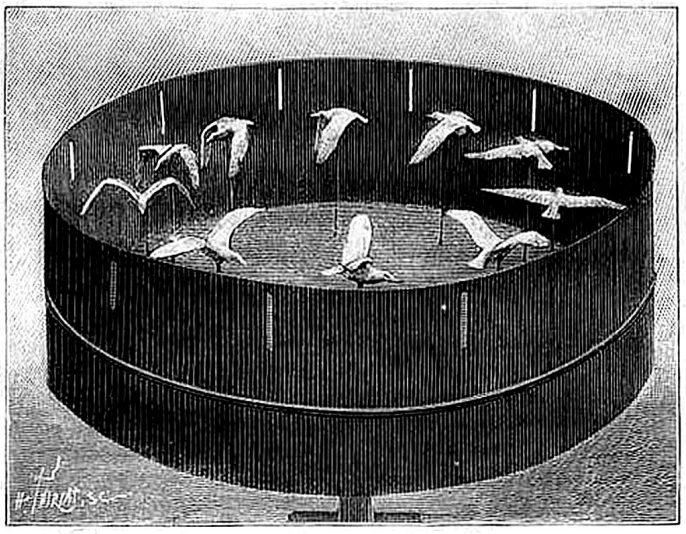


Fig. 9. — Zootrope dans lequel sont disposées 10 images en relief d'un goéland dans les attitudes successives du vol.

Figure 4.13: Sculptures of birds in flight mounted in a zoetrope[92]

[90]Marta Braun, *Picturing time: the work of Etienne-Jules Marey (1830-1904)* (Chicago, IL: University of Chicago Press, 1995).

[91]Étienne-Jules Marey, *Movement*, trans. Eric Pritchard (New York, NY: D. Appleton and Company, 1895), p. 21-22.

[92]Étienne-Jules Marey, "Le méchanisme du vol des oiseaux," *La nature. Revue des sciences et de leurs applications aux arts et à l'industrie* (Paris, France) 1888, no. 757 (1887): p. 12.

sional depictions of motion.[93] In focusing on the physicality of movement, Marey also required depth to accurately depict his physiological studies because form is perceived through motion itself. Even though Marey was depicting movement, his zoetrope is a succinct demonstration of the benefits to visual perception of combining 3D form and motion.

Marey's technique has continued to be echoed by many contemporary artists for alternative motivations—such as British artist Mat Collishaw, in his work *All things Fall*.[94] It is clear that what connects these works, in addition to the combination of 3D and motion, is the suitability of short looped sequence to the representation. The movement of a bird, for Marey, was suitably depicted in eleven frames. In Collishaw's work, the looped sequence and repetition of all the visible stages of the animation magnifies the depicted violence in the scene. Employing motion through the use of the cylindrical zoetrope, therefore, defines the experience in this manner. As these works demonstrate, it is not a disadvantage, but a characteristic that can be drawn upon with any new use of zoetropic illusion.

Combining apparent motion and the stereoscope

In addition to the above combination of apparent motion and physical three-dimensional form, several methods for joining apparent motion and the illusion of three-dimensional form were conceived in the mid-nineteenth century. Many of these media conceptions have not survived. For example, Charles Wheatstone, having invented the stereoscope, also identified in 1849 that using the stereoscopic effect in conjunction with the effects of apparent motion, such as the phenakistoscope, would depict all the "appearances of life…[and would be] the illusion of art brought to its highest degree".[95] His observation was an indicator for a utopian dream that continued for the following two decades to achieve stereoscopic photography in motion.[96] According to Zone,[97] even though Wheatstone had described the phenomena, it is unclear whether this device was built, as no evidence exists today. The first stereoscopic motion device to be patented was rather the "Bioscope" in 1852 by Jules Du-

[93] Zone, *Stereoscopic cinema and the origins of 3-D film, 1838–1952*, p. 35-39.
[94] Collishaw, *All things fall*.
[95] Mannoni, *The great art of light and shadow: archaeology of cinema*, p. 238.
[96] Zone, *Stereoscopic cinema and the origins of 3-D film, 1838–1952*, p. 28.
[97] Ibid., p. 30.

boscq, who had been advised of Wheatstone's suggestion.[98] Thus, similar to Wheatstone's description, this medium combined principles of the mirror stereoscope and the phenakistoscope (Fig. 4.14).

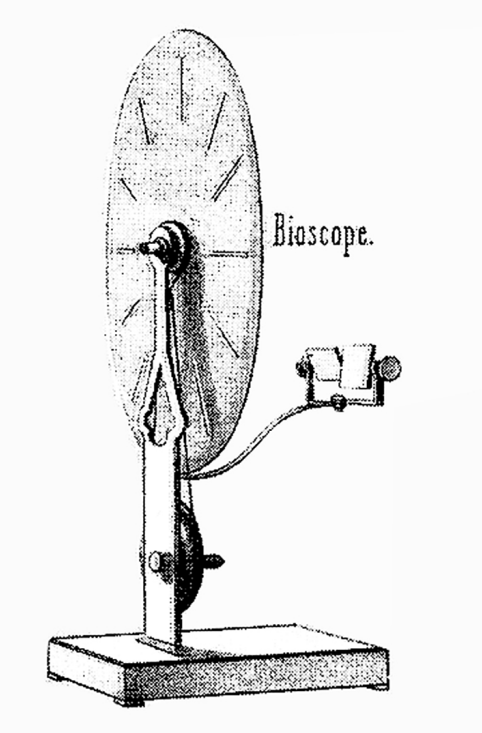


Figure 4.14: Advertisement for the Duboscq Bioscope, 1853[99]

It should be emphasized that many lessons can still be learned from the early combination of these visual illusions in the nineteenth century, as they were not wholly successful.[100] Other early pioneers were attempting various combinations of stereoscope and apparent motion machines.[101] One such pioneer, Antoine Claudet, described the principal difficulties in using discs and cylinders as the means to create a stereoscopic illusion with motion Zone.[102] The Bioscope disc, for example, showed the stereo images in a vertical arrangement, which meant that each image was mov-

[98] Nicholas J. Wade, "Wheatstone and the origins of moving stereoscopic images," *Perception* (London, UK) 41, no. 8 (2012): 901–924.

[99] Mannoni, *The great art of light and shadow: archaeology of cinema*, p. 240.

[100] Wade, "Wheatstone and the origins of moving stereoscopic images."

[101] Mannoni, *The great art of light and shadow: archaeology of cinema*; Zone, *Stereoscopic cinema and the origins of 3-D film, 1838–1952*.

[102] Zone, *Stereoscopic cinema and the origins of 3-D film, 1838–1952*, p. 29.

ing at a different speed around the centre of rotation, affecting the quality of the illusion. Claudet also identified that arranging the images on a curved surface, as would be in a zoetrope format, physically bent the images creating disparity in the focus between the stereo images.

During this period the phenomena of apparent motion was not well understood—it was thought to be related to related to retinal "fusion"[103] of many images into a single object. Later scholarship and description of the phenomenon used the idea of "persistence of vision", which was an erroneous theory contending that "through some peculiarity of the eye an image is retained for a fraction of a second longer than it actually appears".[104] This imprecise theory remains a fallacy in the animation and film fields, and is a term that should no longer be used in relation to effects of apparent motion;[105] indeed it has long been disproven to be the cause for the perception of apparent motion.

Empirically, then, it was found that the presented stereo images needed to be momentarily still for the illusion to be successful—a principle known as "intermittent motion". Even though the theoretical understandings were not accurate at the time, Wheatstone was an early adopter of intermittent motion in his own devices,[106] and understood the import for the combination of motion and stereoscopy. In two-dimensional illusions, slight movements were insignificant in devices that continued to rotate at the point where the image is visible to the viewer, as is the case with the zoetrope. In stereoscopy, however, this affected the precise focus required to perceive the depth, rendering the resultant effect uncomfortable and undesirable.[107] Engineers explored other formats to rotate through the images—a more successful attempt was Coleman Sellers's stereo movie peep show (Fig. 4.15), constructed in form in a similar arrangement to the mutoscope. This arrangement, Sellers noted, had "a great advantage in keeping the picture in view for a long time".[108]

Due to these high technical demands, none of these combinations reached any

[103]Joseph Anderson and Barbara Anderson, "The myth of persistence of vision revisited," *Journal of film and video* 45, no. 1 (1993): p. 5.

[104]Arthur Knight, *The liveliest art: a panoramic history of the movies* (New York, NY: New American Library, 1957), p. 14; Anderson and Anderson, "The myth of persistence of vision revisited."

[105]Anderson and Anderson, "The myth of persistence of vision revisited."

[106]Martin Quigley Jr., *Magic shadows: the story of the origin of motion pictures* (Washington, DC: Georgetown University Press, 1948), p. 110.

[107]Wade, "Wheatstone and the origins of moving stereoscopic images."

[108]Coleman Sellers, Exhibiting stereoscopic pictures of moving objects, `http://pdfpiw.uspto.gov/.piw?Docid=00031357` (U.S. patent 31,357, issued February 5, 1861).

social or commercial success at the time; the larger number of photographs required was prohibitive to portray a single effect.[109] Also, as discussed earlier, machines that rotated to create apparent motion could only ever show a few seconds of repetitive illusion—this outcome did not practically justify the means to produce the illusion. Therefore the illusion could not feasibly proliferate the consumer market. Virtual reality and stereoscopic film are still relatively new mass media phenomena; the combination of stereoscopy and apparent motion has required significant technological development and implementation in order to be practical. In many situations it is simpler and easier to link motion and depth by a combination of depth from motion and motion parallax, rather than using stereoscopic vision.[110]

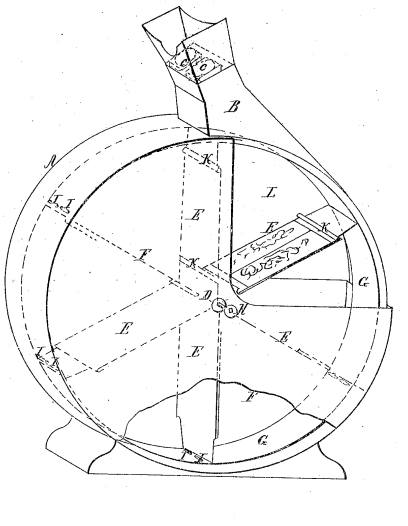


Figure 4.15: Patent drawing of Coleman Sellers's stereo movie peep show[111]

Other three-dimensional motion machines

Many attractions of the nineteenth century were remediating ideas from other early media to offer new public exhibitions. In particular, hybrids and rearrangements of panorama, diorama, and other three-dimensional illusions were surfacing as "vir-

[109] Zone, *Stereoscopic cinema and the origins of 3-D film, 1838–1952*, p. 27.
[110] Wade, "Wheatstone and the origins of moving stereoscopic images."
[111] Sellers, Exhibiting stereoscopic pictures of moving objects.

tual voyaging" became a new fascination.[112] In 1895, Francovich and Gadan, patented their design for the "Stéréorama mouvant", or moving stereorama (Fig. 4.16), that depicted a sea voyage along the Algerian coast. A rotating cylindrical painting was centered in a large circular "trocadero" (exposition space) that housed the work. The construction had viewing windows positioned in a semicircle for large audiences to peer into the space (Fig. 4.17). Surrounding the cylindrical painting were cutouts of waves and ships that created a motion parallax depth effect as they were rotated mechanically.

Whilst this work perhaps does not depict three-dimensional form of the near-field, it does provide some interesting comparisons to other early media. Arrangements looking inwards into the construction were common, stemming from the traditions of the peep show; however, much like the kaiserpanorama, the stéréorama's mechanical rotation extended this arrangement for multi-viewing for a larger public attraction. The arrangements of these larger devices were the inverse of other circular media such as the panorama, that placed the audience in the centre of the construction to envelop them in the experience (Fig. 4.18), and as such, excluded immersion. The unique difference of the stéréorama was that the viewing points were linked chronologically because they were all windows onto a central physical installation; whereas, the movement of the kaiserpanorama could be likened a slideshow, that had no thematic or illusionistic chronology. As summarized by Crary:

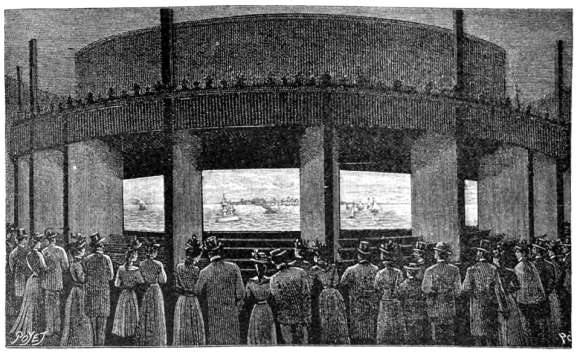
> By what logic of temporal sequence or spatial continuity does one move from the interior of the papal apartments in Rome to the Great Wall of China to the Italian Alps at 120-second intervals? (Crary[113])

Walter Benjamin, himself a kaiserpanorama enthusiast, noted this as a charm of the medium;[114] the jumbled sequence meant that there was no real beginning as one would expect in a narrative. Crary, however, suggests that the kaiserpanorama anticipated Edison's kinetoscope, in that it used multiple individual viewing stations located in a public place; even though it only showed still images, the two machines were similar as automatic and economic consumptions of hardware and software

[112] Huhtamo, *Illusions in motion: media archaeology of the moving panorama and other related spectacles*, p. 307.
[113] Crary, *Suspensions of perception: attention, spectacle, and modern culture*, p. 138.
[114] Oettermann, *The panorama: history of a mass medium*, p. 230.

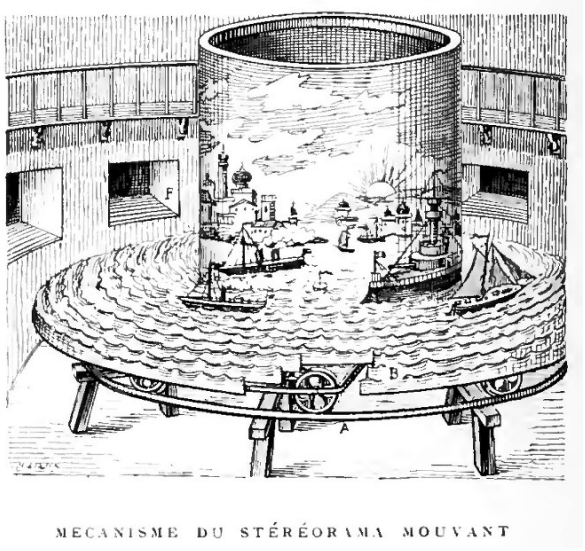
owned by a single operator.[115]

The impact of these changes in engagement, however, removed the illusion from earlier hand controlled interaction methods. As timelines lengthened, and motion fully mechanized, subjects and narratives could sustain attention as much as the interest of the illusion itself. Importantly, unlike the zoetrope and other hand con-



STEREORAMA—VOYAGE FROM BONE TO ORAN.

Figure 4.16: Illustration of the Stéréorama mouvant[116]



MECANISME DU STÉRÉORAMA MOUVANT

Figure 4.17: Illustration of the Stéréorama mechanism[117]

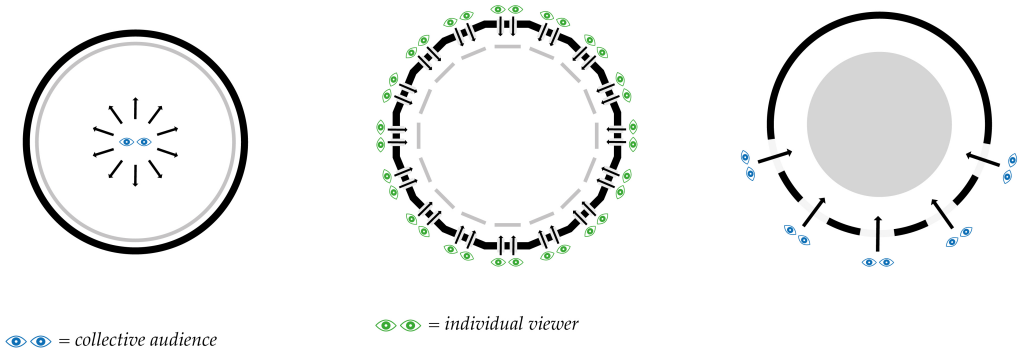
[115]Crary, *Suspensions of perception: attention, spectacle, and modern culture*, p. 136.

[116]Orson Desaix Munn, ed., "The panoramas of the exposition of 1900," *Scientific American supplement* (New York, NY) 50, no. 1285 (1900): p. 20602.

[117]Albert Quantin, *L'Exposition du siècle* [The exhibition of the century] (Paris, France: Le Monde Moderne, 1900), p. 352.

trolled devices, these media represent some of the ways in which the rhythm and timing could be controlled externally,[118] which, as discussed, is a crucial element in film and animation today.

In conclusion, motion plays a vital role in representations of three dimensions; from the effects it has on perceptions of three-dimensionality, to the effects on timing, interaction and audience arrangement of the medium overall. The methods by which the motion is implemented deeply affects these factors. Motion, caused by human interaction, minimizes the artistic control of timing and rhythm, as with the zoetrope, or mutoscope. Automated motion, as with the stéréorama and kaiserpanorama, limits interaction and haptic engagement that supports perceived tangibility of the work. Nonetheless, such automation of motion clearly assists in the engagement of a media work with larger, group audiences. Sequences in these devices did not necessarily create linear narrative; extensive narrative in many of these devices was impossible, the physical implementation simply did not allow enough frames, and sequence more generally pertained to a simple action. The frames in the sequence may have been completely unconnected from one another, even though they were in motion, as was the case with the kaiserpanorama; or else they could be



(a) Central audience position of the panorama

(b) Circular audience views of individual slides in the kaiserpanorama

(c) Circular audience views of a central installation in the stéréorama

Figure 4.18: Approximations of audience arrangements in selected old media

[118] Crary, *Suspensions of perception: attention, spectacle, and modern culture*, p. 136.

inherently linked, such as the window views of the stéréorama. Furthermore, certain combinations of motion and depth illusion will impact the quality of the representation. Marey's 3D zoetrope, the kaiserpanorama and the stéréorama were stable illusions, whereas combinations of early apparent motion machines and stereoscopes were often fraught with technical difficulties. Apparent motion and stereoscopy is much more stable in contemporary devices because technology affords a precision that proved difficult to engineer when physical rotation is used to induce the illusion of apparent motion. All of these discussed elements are active considerations when remediating historical media. These excavated examples and their surrounding contexts highlighted principles that were invaluable to the design of the installation for this project, as to be discussed in the next section.

Chapter 5

Intervention

This chapter relates to design and implementation. Section 5.1 discusses the brief in greater detail, and how the research from the excavation was incorporated into the design. Section 5.2 presents how the team technically implemented the design.

5.1 Remediation and design

Interpretation of the brief

On receipt of the brief, the curatorial aims, themes and narratives for the exhibition and the individual spaces were given clarity—there were noticeable dominant curatorial threads that were important to consider when designing; discussed as follows:

- Juxtaposing old and new artworks whose forms were reflections on similar themes

The notion to reconstruct medieval statues "as new" was already a good reflection of this theme—however, if the final reconstruction stage was shown in isolation, many temporal aspects to the work would not be addressed. The approach was therefore to make the combination of differing temporalities explicit, by including reference to the original statues, and showing the narrative of full reconstruction process— beginning, middle and end. Additionally, an early challenge was to design a work that would both present itself as technology but also fit in with an exhibition style that very much referred to classical understandings of artistry i.e sculpture.

- Each work was an artistic three-dimensional sculpture with physical presence

As discussed in the context (Section 2.1), and presence excavation (Section 4.1) of this thesis—the desire to make the medium transparent leads to great difficulty in appropriating it in to a public exhibition in a shared space. The design approach for this work, therefore, also sought to mirror a natural interaction in an art exhibition: allowing for active/passive engagement, multi-user viewing, and interpretative viewing. Also, an aim was to work towards equivalence of the outcome in relation to the surrounding artworks; to give a work of digital sculpture the same level of presence, and equivalence, to physical sculpture.

- Most pieces were sculpted or constructed in wood, and left with a natural, or worn finish

The dominant, artistic aesthetic highlighted the clear problems of simply using common media that would inherently juxtapose against this curatorial decision. There was not necessarily a single approach to this problem, however, since there were concerns also towards the naturalization of the work in the space, the idea of emulating the material nature of the rest of the exhibition seemed a logical approach; any aesthetic decision to have contrasted the exhibition style would have needed to be careful and intentional, rather than dictated by the choice of medium.

- The desired focus was on artistry and interpretation

The exhibition was regarding cultural heritage, however, the curatorial intention was as an art exhibition, rather than an explicit educational intent. Of course, this did not mean that it was neither educational nor informative; rather these aspects were being implemented through ambient means, as opposed to implementing measurable learning goals. Clearly, then, working towards a specific functional media experience was not suitable—particularly so, as separate portable tablets were to be provided as a functional guided tour.

Towards the beginning of the project, both AR and VR were considered for their capabilities in mediating forms in space—however, these media dictate complexity, and there simply was not enough time, funds or resources for development. Thus, media archaeological excavations, as denoted in Chapter 4, were used to pinpoint the characteristics that could forge a new approach without the necessity for high-level development (see Fig. 5.1).

Figure 5.1: Remediation of old media in the design, influenced by the excavation

1a–d	Four stereoviewers arranged in a circle, influenced by the Kaiserpanorama
2	Mask of the Holmes stereoscope
3	Closed-design of the Brewster stereoscope
4	Fixed point of view, matching the central table, influenced by Pozzo
5	Each viewpoint is linked sequentially to the central model, like the Stereorama, but showing different stages of reconstruction, like the Kaiserpanorama
6	Central models bring puporseful presence in the space, presented much like Marey's white bird figurines to emphasize form
7	Rotation to increase the 3D effect
8	Using digital sensing to connect views and model, to avoid the short timelines of apparent motion machines and complications of combining them with stereoscopy

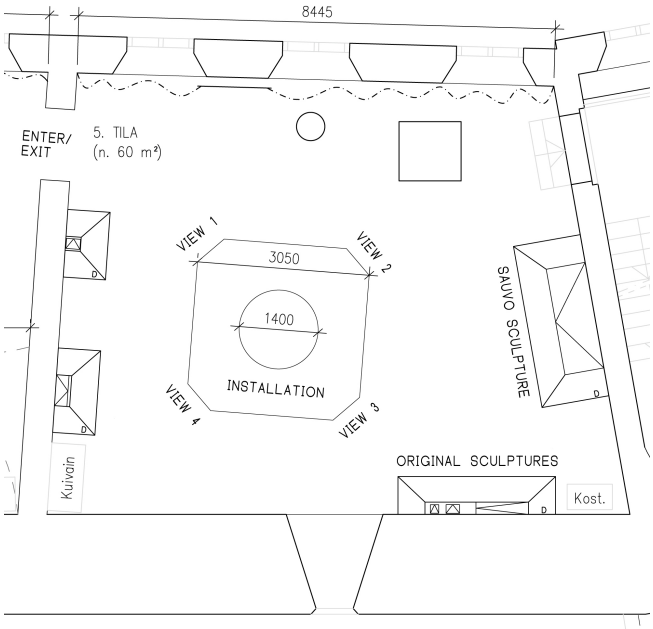


Figure 5.2: Plan of the exhibition space

Space and presence

Foremost in the work, characteristics from old media were used to highlight mediation and give presence to the work in the space. In the presence excavation (Section 4.1), it was discussed how hypermediated spaces, such as cathedrals, use multiple representations to impart an overall theme—and this was compared as a similarity to a museum space."Power, strength, honour and the battle between good and evil" was the theme for the particular exhibition space of the reconstruction, and all sculptures, both contemporary and medieval, related to this theme in their form and narrative. Therefore, in designing the installation, the elements were arranged to construct the visitor's gaze that alternated between relevant facets of the work and other pieces in the space: the original objects on display and other similar work in the space, the physical "outer form"[1] of the installation, and four viewpoints displaying different stages of the digitally reconstructed sculptures (Fig. 5.2). The work used a 3m/sq. area that the visitors could walk around entirely, and freely approach and withdraw from each viewer to take active and passive viewing into account.

Form and arrangement

The main inspiration from the excavation was the form and arrangement of the kaiserpanorama (see Fig. 4.7). The context for which this medium was made—curated public displays of cultural stereoscopic images—was clearly reflected in the design (Section 4.2), and easily adaptable to this project as a way to naturalize stereo multiviews in a space. Of course, the option to seat the audience was not wholly necessary—the kaiserpanorama offered many viewing points for many images. Here, the reconstruction only required, at the most, a few minutes of viewing time and thus the seats were switched to a standing position with tripods so the visitors could interact, and then continue freely walking around the exhibition.

Whilst the kaiserpanorama was arranged in a circle, this did not bear any relationship towards the images that were shown, it was a practical design; however in a medium such as the stéréorama (Section 4.4), the circular arrangement did have this relationship. All audience members were looking in towards the same central installation; therefore, their views were 'offset' sequentially by the angle from which they

[1] Huhtamo, "Time-travelling in the gallery: an archaeological approach in media art," p. 244.

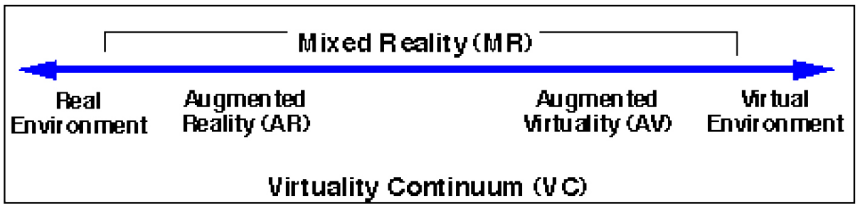


Figure 5.3: Simplified representation of a "virtuality continuum"[2]

were viewing in to the space. The installation design remediated this characteristic combining it with the stereoscopic arrangement from the kaiserpanorama.

View matching—an augmented reality effect

In seeking alternatives to common media that display three-dimensional forms, the techniques shown by trompe l'oeil (quadratura) paintings were identified as having a similarity to augmented reality; these paintings augment the ceiling, and work using a fixed position illusion (Section 4.3). Therefore, taking the above idea from the stéréorama one step further, the design incorporated a fixed position illusion at each viewing point—on looking through the stereoscope, the scene matched the central model. This was to create an AR 'effect'—the augmentation occured in the mind of the viewer rather than in the computation of a device.

In this sense the effect could not be termed a 'mixed reality': there was no direct mixing of display as would fit on to the reality-virtuality continuum as described by Milgram and Kishino[3] (Fig. 5.3).

Other research has also identified this continuum as a problematic explanation where the augmentation is sensorial rather than visual; terms such as "dual reality"[4] have been used to describe different types of connections between real and virtual worlds that do not have explicit visual combination, but rather use sensors and actuators. In this case, the connection was also sensor-controlled but output visually—thus, could most accurately be termed as a 'substitute reality'—four digital views that overlap, match, and replace the physical objects/space at the point of viewing.

[2]Paul Milgram and Fumio Kishino, "A taxonomy of mixed reality visual displays," *IEICE transactions on information and systems* 77, no. 12 (1994): p. 1321.
[3]Ibid.
[4]Lifton and Paradiso, "Dual reality: merging the real and virtual."

Central Models

Again, as shown in Italian quadratura (Section 4.3), the fixed position illusion required a point at which the scale matches reality in order to achieve the effect. Combining the views and the central model was key to the correct interpretation of scale when looking through the viewing points. The central models were provided as an indicator of the starting point of the reconstruction, since the originals had deteriorated to a stage where they were no longer part of their original set, and lost their relationship to the other elements of the depiction. The originals also could not be brought together in this way, since they were of differing scales, and extremely delicate.

It would not have been ethical to materially mimic the models as the original objects; since the originals were to be displayed in conjunction to the installation, the models were materially rendered to draw the focus to the form only, and to allow the digital reconstruction to communicate the other properties—colour, material etc. This physical separation was designed to encourage separate examination of the original objects and the installation, rather than follow with the usual means of displaying the augmentation over the top of the original object.

Design of the stereoscopes

The stereoscope could easily be conflated with modern day head-mounted virtual reality as an earlier version of the same visual illusion—both media look similar and use stereoscopy to mediate depth. However, the perceptions they give are quite different. Today, with the autonomy and movement of the viewer, and increased immersion, virtual reality is adapted for the mediation of digital environments. The nineteenth-century stereoscope, in spite of the later appropriation for other types of representation, for example distant landscapes, the excavation in Section 4.2 highlights the efficacy of this medium as primarily for the representation of form in the near-field. It therefore is an ideal mediator for digital sculpture.

Additionally, the different perceptions of each of the three predominant nineteenth-century models was examined—the design used the closed Brewster model, as this format is crucial to a strong perception of looking in (or out) to another space. Even though the overall design was a hypermediation, immediacy was required, to a certain extent, at the point of looking through the viewer. For this reason also, the

mask section used the hood from the Holmes model to block out distracting factors that could affect the experience, such as strong spotlights to illuminate the work, and movement of others in the space.

Motion

Our perception of three-dimensions is scientifically linked to motion; historical scientists, such as Marey, designed combinations of three-dimensional models and apparent motion for this reason (see Section 4.4). The rotation was included in this design, principally, for the very same reason—to mediate the digital 3D form with the highest perceptive efficacy without building it physically.

Initial design work looked in to methods that could combine apparent motion and stereoscopy, however, as also described in Section 4.4 are two main factors/concerns to consider. Firstly, that apparent motion does not mediate lengthy timelines: these illusions are repetitive and frenetic—a characteristic that was not ideal for this brief. Secondly, that the combination of apparent motion and stereoscopy was notoriously difficult to achieve. Therefore, the conclusion was to rotate the central model at a reasonably slow rate using a motor, rather than hand-propelled motion.

The rotation was also critical in other ways: for example, the rotating views showed each reconstruction stage at the viewpoints in 360 degrees—had the model been still, each view would be 'locked' to show only one angle of the central sculptures. Also, the rotation in the physical space drew attention as an indicator of a technological experience that juxtaposed against the stillness of the rest of the exhibition, solving some of the earlier concerns on the interpretation of the brief.

Material & aesthetic

Whilst the concepts and perceptions of the excavations were important, the intention was not to mimic or reuse the nineteenth century aesthetic. This aesthetic had no relevance to timelines and narrative of the exhibition or the reconstruction. Where possible, natural wood was used for the benefits of naturalization into the space, and for experiential benefits: the tangibility of the digital sculpture was experienced through interaction with the medium. The design aesthetic was crafted mostly from a practical perspective for example, the shape and style of the viewer was designed for a process that was easily repeatable using laser cutting methods—this was the

case, whilst all the time being mindful of how these elements looked together when combined and in relation to the aesthetic aims of the exhibition.

Research in to materials and artistic methods of the digital reconstruction was conducted to ensure a knowledgeable approach—this is discussed in greater detail in the production section (5.2).

Accessibility

The design was required to be suitable for children and accessible. The tripods were adjustable, and the fixed view to be lowered, to an appropriate height for a wheelchair user on request. However, in circumstances for young children, steps were provided.

5.2 Production

My role and the production team

The project was a collaboration between Kansallismuseo, lead by Sanna Teittinen, and the Systems of Representation research group at Media Lab, Aalto University, lead by Professor Lily Díaz. My role in the production was the concept, design and fabrication of the installation, the photogrammetry of the original statues, and project management with collaborators, specialists and advisors, whom I worked with very closely throughout the project.

My main collaborator for the production was 3D artist, Topias Airas, from Metropolia University who created the 3D digital artwork of the reconstruction. To develop the technical aspects of the project, engineer Janne Ojala also of Aalto University, worked on the mechanics and supervised element of hardware design and development. I also collaborated with James Geraets of the University of Helsinki, to develop and implement the electronics and software. Advisors included Kai Lappalainen at MediaLab, Aalto for the photogrammetry and design of the installation, Solomon Embafrash and Aalto Fablab for fabrication of the work, Topi Falkenberg, Jari Simanainen and Pauli Åberg of Rakkenuspaja Aalto also for fabrication and build.

Figure 5.4: Camera angles used for digital reconstruction of the Princess Cleolinda statue

Data collection and reconstruction

The first stage in the project was to capture the sculptures and reconstruct them digitally using close range photogrammetry techniques. Photogrammetry is the technique of reconstructing the position, orientation, form and size of objects from digital photography, without any necessity for physical contact,[5] and therefore, is an established technique in architecture, archaeology, cultural heritage and other fields pertaining to digital archiving and conservation.[6] The technique involves shooting many images around the object, from different angles (Fig. 5.4). Through subsequent pattern matching and computational analysis, an object "point-cloud" is constructed from three-dimensional measurements that are triangulated using feature points in the images. The 3D topology of the digital mesh, and surface texture, is then able to be reconstructed computationally from the information in the point cloud.[7]

The method during this project used a Canon-DSLR camera mounted on a tripod

[5]Karl Kraus, *Photogrammetry: geometry from images and laser scans*, 2nd ed., trans. Ian Harley and Stephen Kyle, vol. 1, De Gruyter textbook (Berlin, Germany: De Gruyter, 2007).

[6]Fabio Remondino and Sabry El-Hakim, "Image-based 3D modelling: a review," *The photogrammetric record* 21, no. 115 (2006): 269–291.

[7]T. Luhmann et al., eds., *Close-range photogrammetry and 3D imaging*, 2nd ed., De Gruyter textbook (Berlin, Germany: De Gruyter, 2014).

that was moved gradually around the statue to shoot images at roughly 10 degree intervals, with a relatively small aperture to keep the whole image in focus. This was repeated several times to take the photos from high-angle to low-angle shots, circling the statue. The images were uploaded to a processing cloud and reconstructed using Autodesk's ReMake software. This was repeated for each statue during one full-day, and two half-day sessions in the photography studio at Kansallismuseo, Helsinki. Kai Lappalainen (MediaLab, Aalto University) advised during this stage of the work.

A controlled environment was required, as the process took around 2.5–3 hours per statue, during which time the background was required to be entirely still; any background feature point could have also been referenced by the algorithm during reconstruction, so any background change risked point misalignment and failure of the reconstruction. It was also found that the mesh reconstruction worked best if a full set of images with whole object in frame was included for processing, in addition to close-ups for high quality textures. In the case of the horse statue, this required smaller apertures and longer exposures to achieve a focal plane for 3/4 angles—this realization resulted in the horse statue being shot twice to achieve a good reconstruction. Once processed, all of the resultant photogrammetry meshes required cleaning to delete unwanted geometry and create the final digital reconstructions of the original statues.

Modelling

Scale matching The 3D artist, Topias Airas (Metropolia University), was responsible for the digital modelling, texturing, animation and rendering of the reconstruction. However, certain aspects of this were heavily affected by the installation design, and vice versa, in order to match the digital and physical models for the designed illusion. Firstly, we worked together to determine the overall scale of the work. The original sculptures were each of their own scale, as they were not part of the same set originally, thus, they had to be adjusted slightly so they looked proportional to each other in the scene.

Following this, we worked out the diameter of the tabletop required based on the size and rough positions of the models. We initially produced measurements for the installation based on the original size of the Cleolinda model, and using the com-

mon positions of each component from other similar St. George and the Dragon sets in Finland. The arrangements were usually linear, as they were displayed against walls of the church (Fig. 5.5). However, this positioning was not a suitable artistic arrangement for a circular display. Additionally, the scale would have required an impractically large area within the exhibition space as a two metre diameter tabletop was required. We therefore rearranged the models to suit the circular setup, and worked to an 80% scale of the original Cleolinda model, requiring an tabletop size of 1.4m diameter.

Research and design for the four viewpoints The installation design required four viewpoints that demonstrated reconstruction stages (see Fig. 1.2), that would mimic a process that may occur in actuality. To gain the material knowledge required for the design of these viewpoints, we visited the conservationists working at the museum. We were able to get very close to the original sculptures and other medieval sculptures that were to be displayed in the exhibition. The following is inspiration we found to design each viewpoint (visual details can be seen in Fig. 5.6):

- Viewpoint 1: A complete St. George and the Dragon set from Sauvo was included in the exhibition (see Fig. 3.1). It was well preserved in form. The first viewpoint was therefore designed simply to show the equivalent for the original statues we were working with. The original mesh and textures from the photogrammetry were used, but the objects were displayed "in position". Within the context of this art piece, it created a faux decayed version of a set that never was, giving back some of the historical gravitas the sculptures had lost as individual components. This could not and should not have been done with the physical versions, for reasons of conservation and ethics, which justified the use of technology for artistic interpretation.
- Viewpoint 2: This viewpoint was designed simply to indicate new geometry, but through the material mimicry, rather than some other kind of functional digital indicator. The original sculptures made the artist and their process present through the visible chisel marks on the surface, that were obscured in other areas by the paintwork and finish. Therefore, Topias mimicked this, as if he were working in wood, but using his sculptural skills digitally, giving himself the same presence as any artist would have working in wood.

(a) Common linear arrangement

(b) Background and lighting influences

Figure 5.5: *St. George and the Dragon*, Hattula Church, c. 1500

(a) Exposed chisel marks

(b) Hair, dress and primer detailing

(c) Horse body painting detail

(d) Dragon head form and painting

(e) Sample dress gilded pattern

(f) Traces of painted face details

Figure 5.6: Sample research photos of statues that informed the digital reconstruction stages

- Viewpoint 3: This view was perhaps the hardest to conceive. We had to investigate processes that came in between carving and painting. The conservators had explained that gauzes and ground chalk were used to prime the sculpture surface before paint was applied. This could still be seen on the surface of the medieval statues, but it is not an aesthetic that would ever be reconstructed unless the work was physically rebuilt, and even then, not displayed during this stage. We used the traces as reference, and then imagined the aesthetic. The dragon was included at this viewpoint rather than the previous viewpoint to to give some interest to the composition, and a sense of a process "snapshot" rather than completed stages. Topias modelled the form of the dragon based on the other sculptures from Sauvo and Hattula.
- Viewpoint 4 (completed reconstruction): Colour traces, expressions, painting technique, gilding, and other material detailing were all based on the conservators information from the sculptures themselves, other sculptures in the exhibition, or in Finland, such as the set in Hattula. Other processual details that could not be seen visually were provided verbally by the conservators and translated visually by Topias, such as the armour detail for St. George.

Background design The background aesthetic was designed to ambiently mimic a plain interior of the church in each scene, but keep the focus on the models in the scene—white lime plaster on stone for the walls, and an old wood texture for the table—referenced from the settings of other St. George and the Dragon displays in Finland. The lighting was also inspired by the Hattula display, that has a window, lighting the sculpture naturally from the top (Fig. 5.5).

3D Printing and mounting the central model

Preparation and printing The 3D printing was completed using the services and advice from Aalto Fablab. Due to the size of the prints, the Ultimaker 2 extended was the only 3D printer feasible for the printing. The models were printed in white PLA (polylactic acid) material, with an .8mm wall thickness and 20% infill mesh. These settings kept the print times sensible, the model shell stiff, and maintained a reasonable quality print that minimized striation (the horizontal lines caused by printing in layers) (Fig. 5.7a).

Once the overall scale had been decided, the cleaned photogrammetry mesh for each statue was prepared for printing using Autodesk's MeshMixer software. The software automatically checks the geometry for any deformation or holes that will cause printing problems. Even with the capacity of the Ultimaker, the sculptures had to be cut into constituent parts for printing—this was also completed in Meshmixer. Additionally, a joint between the St. George statue and the horse statue had to be modelled into the mesh so they could eventually be joined together using a strong putty glue. This was done for a graceful join without any additional supporting structures (Fig. 5.7b).

The Cleolinda and St. George statues were both printed in two parts; the horse was printed in seven parts. Each part took between 27–40 hours to print, therefore, the whole process was continual throughout the production period. After printing, the models were removed from the machine and cleaned of the support structures that the machine prints to brace the model during the process. The constituent parts were then glued together using a strong epoxy resin (Fig. 5.7c).

Failed prints Failed prints are caused by a number of factors—machine malfunction, lack of material, loss of power etc. The long print times were risky for these reasons—once a print has failed, it cannot be continued from the point it stopped, the whole print must be restarted. It is also not advisable to print components for one part on different machines, as small variations in the prints could affect assembly. The project deadline was extremely tight, with very little time margin to account for failed prints. One print failure did occur (Fig. 5.7d), however it was not too problematic to the schedule as it occurred early in the print; any further failures almost certainly would have seriously affected the schedule.

Finishing the prints It is usual for PLA models to be coated with an epoxy coating to smooth the surface, however, this leaves the surface with a high gloss finish. To achieve an alternate matte finish, obvious flaws in the surface were sanded down, after which the model was coated with a white wood filler, or spray filler, to fill in the striation lines. The filler was then sanded, primed and sprayed in matte white.

Mounting the models The models on the tabletop were mounted in the same configuration as the digital positions. This required much planning, as there was

(a) St. George upper torso mid-print

(b) St. George printed legs with joint

(c) Horse body in production

(d) Failed print; internal structure breakdown

Figure 5.7: Photos from the 3D printing process

no room for error during production. A full-scale layout plan of the tabletop was printed to transfer the positions of the models, and to accurately mark the drilling points on the tabletop for the vertical wooden mounting rods. The support and rods were also modelled accurately prior to production, so that the vertical height and angle of the horse was precise. The supports were then manufactured using the CNC machine in Aalto Fablab, sanded and fitted to the poles; these were then screwed into the holes on tabletop.

Fabrication and build

Stereoscopes As there were four identical stereoscopes, these were manufactured by laser cutter in plywood, and glued together. The lenses used were from consumer VR glasses. They were mounted on four identical tripods that were purchased and amended to fit the purposes of this project to speed up production. The tripods were adjustable vertically for accessibility requirements.

Table The table base was also purchased and customized for speed. One of the side panels was removable for access to the hardware. The round tabletop was routed out of 18mm laminate board to keep the weight to a minimum.

Engineering

Janne Ojala (MediaLab, Aalto) provided invaluable advice and practical assistance for the engineering of the motor. The motor needed to silently and slowly rotate the wooden tabletop of 1.4m diameter. Initially, it was planned to used a servo motor and drive, that would provide the position of the motor to the computer directly. However, we could not find a suitable servo motor that met the safety specifications. Following this, the final motor used was a exhibition turntable (MTE SWD100), 2.5 rotations per minute, with a maximum load of 10kg, however, in retrospect this was slightly underpowered and a 50kg load would have been more appropriate.

Hardware and software

Hardware schematic The schematic (Fig. 5.8) shows the hardware setup of the final system: four mobile phones connected to a powered USB hub for charging, and also

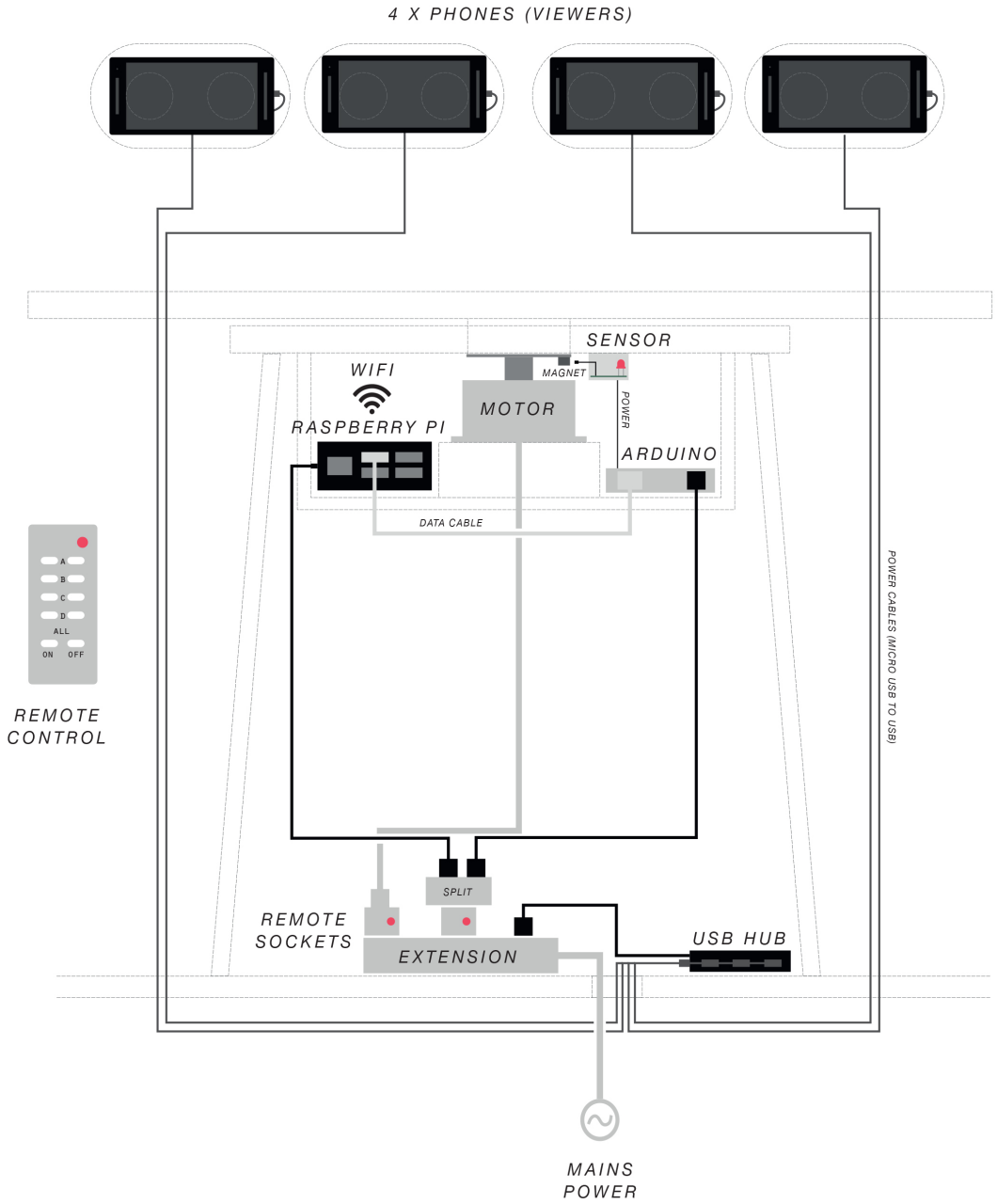


Figure 5.8: Schematic of the hardware setup

connected via Wi-Fi to a Raspberry Pi (RPi), that served as a wireless router. The RPi was connected to an Arduino and hall-effect sensor, that detected each rotation of the table by the magnet attached to the motor. The information from the Arduino was computed by the RPi, which controlled the speed of playback to synchronize the videos on the phones to the central display. The power to the RPi and Arduino, and to the motor were remote-controlled, to allow the museum staff to switch the installation on/off easily. The phones remained powered continuously, and could be reset from the individual viewpoints if needed. The approach for the hardware and software was conceived in collaboration with James Geraets (University of Helsinki), who then implemented the system with advice from Janne Ojala (MediaLab, Aalto).

Mobile phone displays Mobile phones were used for the displays in the four viewpoints, for the advantages that they were inexpensive compared to other display screens, and programmable computer/communication devices that offered a multitude of options to achieve a functional system. The model used was the Huawei Honor 7 Lite, as it offered a 5.2 inch full high definition display, and 2Gb of RAM, for any computational requirements, at a reasonable cost, as four units were required. An app was coded for the phones that displayed the video according to the synchronization information provided via Wi-Fi connection to the RaspberryPi. Another app, StayAlive, was used on the phones to stop the display dimming during playback.

The four digital scenes were rendered by the modeller, Topias, as high definition, side-by-side stereo frames (Fig. 5.9). The frames were then compiled into four separate videos. Each video displayed one full rotation, but had a different starting position: this allowed the scenes to match to the different viewpoints, that were offset by 90 degrees in the installation. The videos were also optimized using FFmpeg software, to ensure that the continual looping of the video did not overrun the phone memory.

RaspberryPi A RaspberryPi 3 Model B (RPi) acted as a WiFi router to connect to the phones, and was also directly linked to the Arduino. Custom code written in Python by James Geraets was used to interpolate and smooth the sensor data to predict the rotation of the table, and thus control the synchronization with the digital displays. As such, the synchronization between the table and phones was not direct:

Figure 5.9: A sample side-by-side stereo frame[8]

the predicted rotation timings were communicated to the phones, and they changed the rate of playback to follow these predictions. The RPi acted also as a web server, hosting the diagnostic and maintenance webpage which could be accessed by phone or laptop by joining the WiFi network.

Arduino and sensor An Arduino Uno was programmed to read the pulses from a sensor that detected the proximity of a magnet that was attached to the rotating motor. The sensor hardware comprised of a hall-effect sensor (A1381EUA-T), a red LED power indicator , a 220Ω resistor, 5V power/ground/analog connections to the Arduino microprocessor (Fig. 5.10).

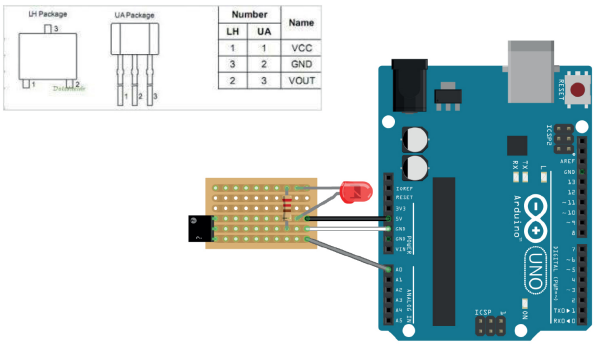


Figure 5.10: Schematic of the arduino and sensor

[8]By Topias Airas.

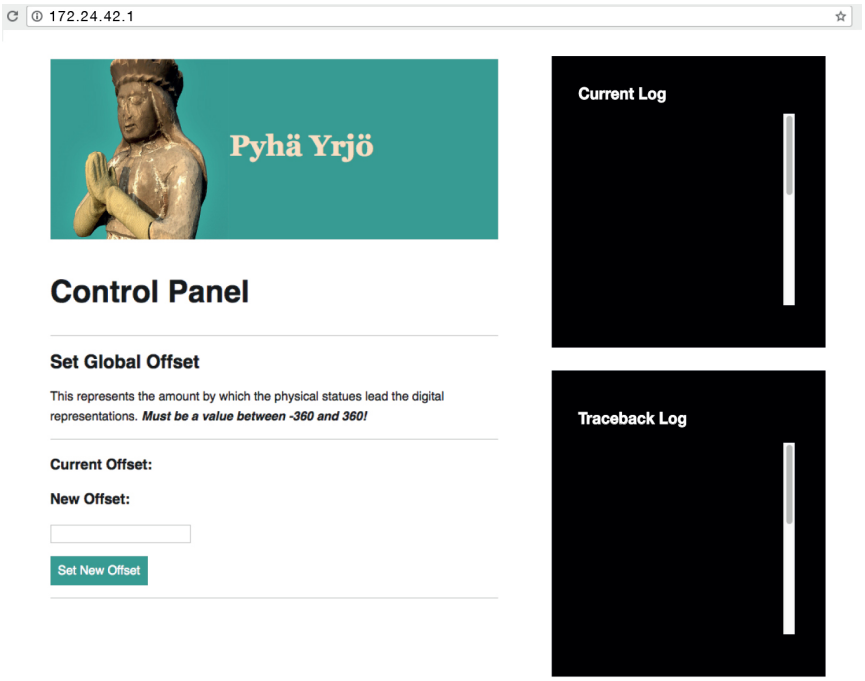


Figure 5.11: Screenshot of the management website

Management website The management website (Fig. 5.11) was created for easy diagnostics should the museum need to communicate an error. It also included functionality to change the "offset" between the position of the central model (tabletop), and the position of the videos (and motor). This was required because the tabletop was not fastened to the motor, for safety reasons. Therefore, if the tabletop needed to be removed and replaced, this function could easily resynchronize the central display and the videos.

Installation

The museum constructed a shallow platform for the installation, based on provided technical drawings, and painted to match the other plinths in the space. This served to hide the cables that ran from the phones to the powered USB hub in the base of the table; also, to secure the tripods into the platform, so they would not get knocked from the correct position. They also provided coloured plastic discs to label each view to a corresponding project explanation that was illuminated on the platform.

The table was installed in the space and levelled, to ensure the plane of rotation of the motor ran parallel to the floor. It was also checked that the tabletop balanced correctly on the motor plate, by attaching weights to the underside. A guard rope was threaded around the installation to discourage and touching of the rotating table—this was important as motor damage could occur.

Maintenance

A manual was provided to the museum staff on site—the staff were also trained in simple aspects of the maintenance, such a resetting the apps and phones. Due to the speed of the production, and minimal testing time, bi-monthly maintenance visits were organized, to reset the whole system; occasionally spares had to be swapped in during hardware malfunctions.

5.3 Final Work

The exhibition opening was on the 27th April 2017, and ran until 17th December 2017. Photographs taken throughout the run are shown in Fig. 5.12.

Figure 5.12: Visitors touring the exhibition

Figure 5.12: Visitors touring the exhibition

Chapter 6

Discussion

The theory of remediation describes how media "are continually commenting on, reproducing and replacing each other".[1] Following the analysis of common three-dimensional digital media in the context of the cultural heritage museum, it appeared that for this project, for the multitude of reasons discussed in Section 2.1, existing devices were not offering the exact qualities desired for the work. Therefore, remediation was necessary to craft the installation.

The media archaeological approach yielded benefits to the project through the break-down and analysis of the concepts that constitute these existing devices, offering insights to approach the remediation. For example, the stereoscopic illusion (the convergence of two images) remains practically the same between nineteenth century stereoscope to a VR headset today; the major change between the two is how the illusion has been implemented, and the cultural forces that have driven those changes—from early desires for immersion,[2] to the logic of transparent immediacy.[3]

Therefore, media archaeology was used to explore the material cultures of new media devices, to derive inspiration from old media in finding new design direction, rather than seeking, in the more literal sense, to put new media into old media devices. It therefore draws some parallels in the use of media archaeology in its design of form, to works such as Jeffrey Shaw's *Inventer la terre*[4] that allude to certain histor-

[1] Bolter and Grusin, *Remediation: understanding new media*, p. 55.

[2] Huhtamo, *Illusions in motion: media archaeology of the moving panorama and other related spectacles*, chapter 10.

[3] Bolter and Grusin, *Remediation: understanding new media*.

[4] Shaw, *Inventer la terre*.

ical media devices, rather than specifically using old media devices and their exact historical aesthetic.[5]

The material aesthetic from the nineteenth century was of little significance for this project, in comparison to the understandings of how early media dealt with form, illusion, perception, scale and arrangement of the viewer. Wheatstone championed his stereoscope with regards to illusions of form[6]—contemporary virtual reality mediates an environment, as opposed to an object, as a result of movement within the digital space, and immersion related to scale. Thus, while the stereoscopic illusion of each is generally equivalent, the media themselves are very different; one is not merely an improvement of the other, each is an implementation that lends itself better to different circumstances.

Similarly, in looking at media development as non-linear,[7] and in consideration of their supportive contexts, it is clear that some ideas have been abandoned, not because the were worse versions of newer media, but that the context of their existence changed. The domestic stereoscope lost its dominance as medium, in part, due to a social association with pornography, and the growing popularity of photography and film.[8] The kaiserpanorama was purported to be attracting visitors until c. 1930s for highly curated content,[9] but was a victim to changing consumption cultures of mass media, for example cinema,[10] or magazines and newspapers for up-to-date visual information for the mass public.[11] Clearly, these ruptures have nothing to do with technological development of better versions of the same illusion. Media archaeology can offer threads of unexplored media designs, rather than assuming old media have nothing more to offer than the new media that we use today. The kaiserpanorama is anomaly in media history—it is not considered a panorama, but a multi-viewer version of the stereoscope;[12] yet, it is highly relevant to surrounding discourse, such as the relationship of the stereoscopic illusion and

[5]E.g. Naimark, *SEE BANFF!*; William Kentridge, *Heartbeat sewing machine*, 2016, Mechanical art installation.

[6]Wheatstone, "Contributions to the physiology of vision I"; Crary, *Techniques of the observer: on vision and modernity in the nineteenth century*, p. 122.

[7]Parikka, *What is media archaeology?*, p. 37.

[8]Crary, *Techniques of the observer: on vision and modernity in the nineteenth century*, p. 127, 133.

[9]Oettermann, *The panorama: history of a mass medium*, p. 230-232.

[10]Ibid., p. 234.

[11]Ibid.

[12]Huhtamo, *Illusions in motion: media archaeology of the moving panorama and other related spectacles*, p.309; Crary, *Suspensions of perception: attention, spectacle, and modern culture*, p. 136.

public exhibition—a subject technology is still grappling with currently.[13]

There are, however, some difficulties in the approach, such as the challenge of combining many timelines and concepts of history,[14] working out which media archaeological insights can be combined into a coherent assemblage,[15] in addition to the actual methods to combine them. For instance, in this project the design work started out with a focus on zoetropes, but as it developed it was clear that more influences from other media were needed to construct a feasible outcome. There would have been, of course, many outcomes possible: this project is one of a multitude of remediation possibilities.

Another challenge with media archaeological approaches to media art, is that the outcome will be somewhat unfamiliar to an audience. An AR experience mediated through a tablet relies on the audience's experience of the tablet device in other settings—knowledge of interaction style and expectation of the object is something that Krippendorff explores fully in The Semantic Turn.[16] Unfamiliarity is to be expected with any new experience of media. The level to which this is problematic depends on the project intentions. In the case of this project, the outcome was intended as a work of art over the requirement for pedagogy. Therefore unfamiliarity with this new media experience was not as detrimental to this project than it would have been for more functional experiences with requirements for measurable learning. There was still, however, some necessity for the narrative to be imparted in an artistic, ambient style.

The contextual analysis of digital media and cultural heritage collaborations (Section 2.1) posited notions for better links between the fields, and thus, more integrated experiences as a result. The first notion dealt with the material and materiality of new media, and the effects of these on visitor interpretation.[17] The media archaeological approach to the project questioned the very fabric of media used to portray objects in space and create illusions of depth. Naturally, this scrutinized the form and material of devices such as tablets and head-mounted displays, and their respective use and interpretations in the museum experience. In addressing me-

[13]Collins, "Current discourse on digital storytelling in museums."
[14]Parikka, *What is media archaeology?*, p. 158.
[15]Ibid.
[16]Klaus Krippendorff, *The semantic turn: a new foundation for design* (Boca Raton, FL: CRC Press, 2006).
[17]Kalay, "Introduction: preserving cultural heritage through digital media."

dia as fabricated objects, it aligned the approach to concerns of material culture, as opposed to concerns of digital experience. It also sought to solve many problems that are inherent to the use of common devices. An illusory approach to AR, rather than the use of technological AR, avoided many associated issues with poor material mimicry and bad lighting matches.[18] It also allowed for the separation of the experience from the original objects, distiguishing it as a design in its own right, rather than a functional interface[19] to an "add-on" digital experience.

The second notion addressed the tendency of media devices to dictate the characteristics of the work. This was addressed by using inspiration from old media techniques; for example, ideas excavated about the fixed multiviews of the kaiserpanorama, and the movement of illusion machines such as the zoetrope, offered alternative ideas to a VR head-mounted display. The work was similar to employing four VR headsets, however, the viewing devices did not have to be moveable themselves unless immersion was necessary, which it was not, or if the experience was meant to be distributed in the space. The design compensated for varying levels of engagement and multi-user interaction by giving each user an equal opportunity to approach a viewing point. In the media archaeology research, it was discussed that many of the nineteenth century devices were solutions to democratize the experience for all audiences, after a period when forced perspective designs, such as stage sets, excluded 99% of the audience.[20] The inclusion of domestic devices in an exhibition demonstrates an equal problem—there seems to be a wide design focus on how the VR experience can resolve this,[21] when perhaps the answer lies in the very fabric of the device itself.[22] As it happens, the panorama democratized the view only in the physical form—its use in a VR headset is once again exclusory. As noted, this project uses more than one fixed point illusion to democratize the view, which is an alternative approach that works for a small audience. The inclusion of the multiviews in this project encouraged team work—it was often observed that groups, including large groups of school children, would work together to understand what

[18] Kamboj, Liu, and Gupta, "A review on illumination techniques in augmented reality."

[19] Jung and Stolterman, "Digital form and materiality: propositions for a new approach to interaction design research."

[20] Oettermann, *The panorama: history of a mass medium*, p. 24.

[21] Roth et al., "Social augmentations in multi-user virtual reality: a virtual museum experience."

[22] Alexander Kulik et al., "C1x6: a stereoscopic six-user display for co-located collaboration in shared virtual environments," in *Proceedings of the 2011 SIGGRAPH Asia conference*, SA '11 188 (New York, NY: ACM, 2011), 1–12.

each view was and consequently understand the whole narrative. As a result, however, those who were not intuitively exploring the work, i.e. passive users, would sometimes miss the message—an issue that the information design surrounding the piece should have offered greater support for.

The final notion addressed the requirement for the designer to be cognizant of any shifts in meaning that occur when creating a visual storytelling based on an object of cultural heritage. Experiences should be designed from a position of knowledge to achieve content integrity,[23] with awareness of the balance between information and entertainment.[24] The intention of the project was not to create informative work, nor entertainment, but an artistic reconstruction. Therefore, artistic enquiry formed the basis of knowledge that underpinned the work, for example, the acquisition of material knowledge, and knowledge regarding the medieval artistic process from the conservators at the museum. Project interests were positioned away from interaction and user experience, and moved toward the interests of the reconstruction itself; the material approach to the reconstruction restored a spatial presence that the sculptures had lost as individual elements. This would not have been achieved if, for example, the digital work had been completed and displayed or projected on a screen—the scale and impact in this method is experienced rather than imagined.

Certainly the feedback received during observations over the run of the exhibition concurred that it was an artistic work, that it did not feel out of place in the space, and that it was interesting way of using technology that had not been experienced before. Some visitors showed enthusiasm for the method in terms of a teaching or pedagogical tool; others as a way to engage children in a subject that is often somewhat inaccessible. Although it was not designed as an entertainment, in some respects it did serve as such, particularly with children, because it was the only digital work in the exhibition; therefore, it still marked itself out as "new" and "interactive" in its nature as technology. However, many children were observed showing or explaining the installation to each other and their parents, which is an indicator that the balance between entertainment and meaningful experience was reasonable.

[23]Starr, "MER at 20: some observations on museum education."

[24]Griffiths, "Media technology and museum display: a century of accommodation and conflict"; Roussou, "Immersive interactive virtual reality in the museum."

There was a noticeable difference between the reactions of adults and children. Museum staff reported that children enthusiastically engaged and often understood immediately, but that many adults showed interest, yet expressed that they did not understand the work entirely. In my own observations at the museum, adults with active engagement, that mirrored the children's engagement came away with the correct understanding. When adults had a more passive engagement, looking very briefly, or only through one or two views, either they asked the staff who provided additional information, or relied on the textual information. The information design for the piece was not optimal (for reasons to be discussed later); this was a weakness of the work, because the narrative was then not always understood.

The interaction did have a slight "gamification" element, in that it required active viewing of all four views to foster the correct understanding. In particular, this was due to the minimal supportive information design. Children had a more intuitive nature for the exploration of the installation, but adults' capacity for engagement was more variable. Children seemed to be satisfied with the simple nature of the narrative, however some adults seemed to expect that a technological solution would be something more, i.e. they expected a functional, non-artistic approach. This was not the design intention: on the requirements of the posited notions, the installation was artistic and considerate to the subject, and appealed as a "new" work whilst also demonstrating content integrity. The visual translation of the narrative was created from a position of knowledge, but it was still open to a certain amount of misinterpretation from the weaknesses in information design. There is also a certain amount of misinterpretation to be expected with any artistic approach that is not explicit in its meaning.

This project has also left many other research developments to be explored, for example, investigating whether a direct synchronization with the table could be achieved, so the rotation could be changed by hand-movement from the audience, rather than the central motor. Also, investigation on whether the illusion needed further support on the outside of the viewers, by including false lenses on the opposite side to the real ones (Fig. 6.1). Additionally, if the project were to be repeated in the future, the inclusion of user testing in a similar environment would also be beneficial—this was not possible due to time constraints. Some issues were highlighted in the information design, for example, the colour spot system (to label the

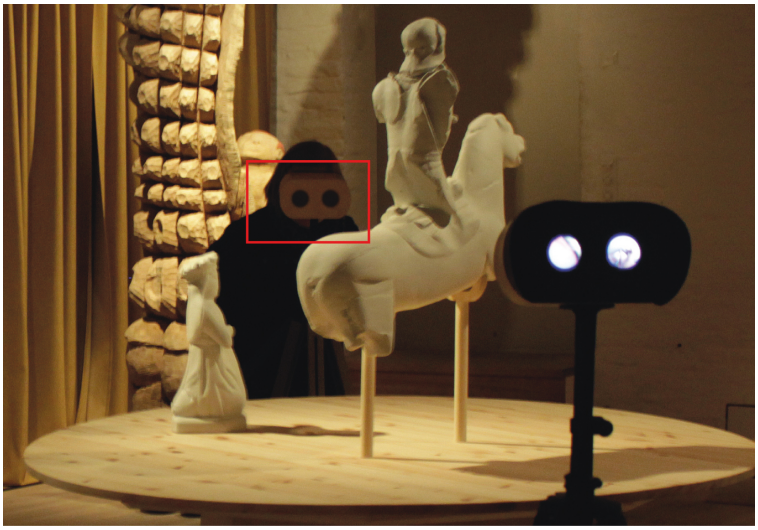


Figure 6.1: Supporting the illusion by using false lenses on the other side of the viewer—a design consideration for the future

views in relation to the caption information) was not effective because the colours were not distinguishable in the lighting of the space. Additionally, elderly visitors had some trouble in reading the descriptions that were displayed on the floor platform, again, particularly with the dim lighting in the space. These are all issues pertaining to the collaboration of this project, the architects and lighting designer, and in retrospect, greater communication between these aspects may have avoided some of these problems. On a more practical note, if I were to build the project again, due to the appeal of the work to children, I would look to use even sturdier construction, improve the fencing for the work to reduce maintenance requirements, and integrate fixed steps to allow younger children to see the views more easily.

There were many factors that were key to the realization of this work. The use of the project-driven method, for example, involved practical considerations, such as deadline and budget, that influenced the approach heavily. This is arguably never an approach a researcher would force themselves into of their own accord, and perhaps explains the multitude of projects that are researching the experiences that can be made with new technology, but rarely the physical form of the medium within the museum. Design engages in problem solving—the nature of the problems, however, are dependant on the circumstances in which they are asked—this is a real benefit to the project-driven method.

The analysis of AR and VR experiences, and the resultant search for alternative methods (that consequently became the media archaeological approach) was required because these media were not feasible as solutions. The development time for good quality AR/VR experiences would have taken far longer than the project deadline. A VR experience is easy to conceive in theory, but the practical aspects of development would have been harder than the alternative approach designed. Having said that, my background in artefact design certainly was an advantage in being able to conceive alternatives, in an interdisciplinary manner between object and media design, inspired by old media devices. Tacit knowledge gave me confidence to know that an approach that rebuilt a physical installation was not only possible, but would lead to a good solution even though at the beginning of the work I had not conceived exactly what the solution would be. The form and style of the work was built precisely for this context; therefore, it would be possible to repeat this process in a similar fashion for other contexts concerned with objects of cultural heritage in a museum exhibition, in the future. In this respect, media archaeology was a productive approach to media installation design, in order to reflect and balance the values of the cultural heritage with capabilities of new media.

Chapter 7

Conclusion

This research did not set out with a strict question; thus, in undertaking it through a project-driven approach, outcomes were highly dependant on the circumstances and choices made during the project. However, in embracing all the complexities that arise from with working in this manner—budget, deadlines, collaboration etc.—creative approaches to problems were found where, in other circumstances, they may not have been. Had the time pressure not have been present in the research domain (a factor that rendered the use of common media devices impractical) it is questionable whether alternatives to AR/VR would have been sought at all. Of course, this is not to say that the approach does not have its drawbacks—there are many things that warrant further investigation from this research that were a result of these complexities and can now form the basis of future research under less constraint. Yet somehow, at least in personal experience, creativity seems to thrive in these circumstances.

Importantly, media archaeology, and remediating past ideas into fresh ideas, has proven to be a method that certainly fosters creative approaches to new media design. In this project, it is demonstrated to be a valid design method for a media installation within a cultural heritage exhibition: remediating historical media, to display a reconstruction of historical sculptures certainly was a useful metaphor, even though it may not have strictly been comprehended by the users. Furthermore, the outcome fluidly embraced the areas between art, design, and pedagogy; media archaeology is an open field that thus far has avoided very strict definition to encourage fresh approaches—this is also the case with its use as an approach to

creativity in new media. It is a method that will foster fresh creative outputs—art, design or otherwise.

Throughout the process of this research, learning of the ingenuity of historical invention was as gripping and profound as learning about any new technological invention of the present day. Media archaeology has also tapped into so many of my interests—new media design, artefact design, set design, pervasive animation—that it has profoundly impacted my own interdisciplinary practice. Certainly there are so many opportunities for design exploration from media archaeological research that it will always be a continual source of inspiration to me in the future.

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